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# Highway Safety Literature

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**NTIS:** National Technical Information Service, Springfield, Va. 22161. **Order by title and accession number: PB, AD, or HS.** When no PB number is given for NHTSA Technical Reports, order by prefacing the HS number with DOT, i.e. DOT-HS-000 000.

**GPO:** Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. **Give corporate author, title, personal author, and catalog or stock number.**

**Reference copy only:** Documents may be examined at the NHTSA Technical Reference Branch or borrowed on inter-library loan through your local library.

**See publication:** Articles in journals, papers in proceedings, or chapters in books are found in the publication cited. These publications may be in libraries or purchased from publishers or dealers.

**SAE:** Society of Automotive Engineers, Dept. HSL, 400 Commonwealth Drive, Warrendale, Pa. 15096. Order by title and SAE report number.

**TRB:** Transportation Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

**Corporate author:** Inquiries should be addressed to the organization listed in the individual citation.

## **ABSTRACT CITATIONS**

# SAMPLE ENTRIES

## FORMAT OF ENTRIES IN HIGHWAY SAFETY LITERATURE

NHTSA accession number \_\_\_\_\_ HS-013 124  
Title of document \_\_\_\_\_ **MAXIMUM BRAKE PEDAL FORCES PRODUCED BY  
MALE AND FEMALE DRIVERS**  
Abstract \_\_\_\_\_ The object of this research was to obtain data concerning the maximum amount of brake pedal force that automobile drivers were able to sustain over a period of ten seconds. Subjects were told to apply the brakes in the test car as they would in a panic stop, and to exert as much force as possible on the pedal over the entire ten second test period. A total of 84 subjects were tested, including 42 males and 42 females. The results indicated that there is a wide distribution of values which characterizes the pedal force that the subjects were able to generate. Male subjects produced generally higher forces than did females. Over half the women tested were unable to exert more than 150 lbs. of force with either foot alone, but when both feet were applied to the pedal, force levels rose significantly.  
Personal author(s) \_\_\_\_\_ by C. R. VonBuseck  
Corporate author (or author's affiliation) \_\_\_\_\_ General Motors Corp.  
Publication date; pagination \_\_\_\_\_ 1973? ; 18p  
Supplementary note \_\_\_\_\_ Excerpts from Maximum Parking Brake Forces Applied by Male and Female Drivers (EM-23) BY R. L. Bierley, 1965, are included.  
Availability \_\_\_\_\_ Availability: Corporate author

NHTSA accession number \_\_\_\_\_ HS-018 924  
Title of document \_\_\_\_\_ **NATURAL FREQUENCIES OF THE BIAS TIRE**  
Abstract \_\_\_\_\_ The lowest natural frequencies of a bias tire under inflation pressure are deduced by assuming the bias tire as a composite structure of a bias-laminated, toroidal membrane shell and rigorously taking three displacement components into consideration. The point collocation method is used to solve a derived system of differential equations with variable coefficients. It is found that the lowest natural frequencies calculated for two kinds of bias tire agree well with the corresponding experimental results in a wide range of inflation pressures. Results of the approximate analysis show that the influences of the in-plane inertia forces on natural frequency may be considered small, but the influences of in-plane displacements are large, particularly on the natural frequency of the tire under low inflation pressure.  
Personal author(s) \_\_\_\_\_ by Masami Hirano; Takashi Akasaka  
Journal citation \_\_\_\_\_ Publ: Tire Science and Technology v4 n2 p86-114 (May 1976)  
Publication date \_\_\_\_\_ 1976; 6refs  
Availability \_\_\_\_\_ Availability: See publication



HS-026 079

### THE NIGHTTIME LEGIBILITY OF HIGHWAY SIGNS AS A FUNCTION OF THEIR LUMINANCE CHARACTERISTICS

A laboratory study was carried out to define the effects of luminance, contrast, color, and driver visual characteristics on sign legibility distance. At the same time a computer model was developed which predicts the legibility distance of a sign, based on laboratory data as well as geometric and photometric variables. A field study was then conducted in which legibility distance predicted by the model was compared with legibility distance measured on a number of real and simulated traffic signs, using a sample of normal drivers. In general, the predictions were within 10% of the measured legibility distances. The results indicate that more highly reflective backgrounds permit somewhat greater legibility distances and reduce the effect of changes in viewing conditions, which can be quite substantial for nonreflective backgrounds. The contrast provided by the legend is very important. Luminance contrast requirements are lowest for highly reflective backgrounds and increase as background reflectivity decreases. In this study, the luminance variables have been expressed in terms of material options available to the traffic engineer. If the data are accurate, as they appear to be, this form of presentation enables material choices to be made at a desk, without instrumentation of any kind. Some related problem areas which require study are the effect of glare sources near the sign, and the maximum acceptable background luminance level.

by Paul L. Olson; Arthur Bernstein

Publ: Human Factors v21 n2 p145-60 (Apr 1979)

1979 ; 13refs

Sponsored by National Cooperative Hwy. Res. Prog. Project NCHRP-3-24.

Availability: See publication

HS-026 080

### RAPID COMPREHENSION OF VERBAL AND SYMBOLIC TRAFFIC SIGN MESSAGES

A "same"/"different" reaction time procedure was used in two experiments to measure the times required to comprehend the meanings of projected slides of traffic signs. The results indicate that signs with symbolic messages can be understood more quickly than those with verbal messages. Visually degrading the signs resulted in a greater decrement in performance for verbal than for symbolic signs. correlational analyses demonstrated reaction time to correlate significantly with a previously obtained measure of sign legibility taken from a moving motor vehicle on a roadway. It is suggested that when ever a traffic sign is to be placed at a particular location, the version should be chosen which displays the intended message the most effectively under the expected environmental conditions. If the relative adequacy of the available versions were unknown, it could be assessed by the techniques of the present study; if no testing were to be done, a symbolic sign should be installed. It is recommended that both legibility distance and reaction time measures be taken whenever a complete evaluation of sign adequacy is undertaken. As a cost- and time-saving measure, a laboratory measure of legibility distance is currently under development.

by Jerry G. Ellis; Robert E. Dewar

TC-98541

Publ: Human Factors v21 n2 p161-8 (Apr 1979)

1979 ; 7refs

Sponsored by Transport Canada.

Availability: See publication

HS-026 081

### RAILROAD CROSSING SAFETY

Although Amtrak statistics show that no school buses were involved in grade crossing accidents with Amtrak trains during the years 1975 through 1977, and the Dept. of Transportation states that school bus transportation is seven times safer than passenger car transportation in terms of injuries/passenger mile, the railroad train still poses a hazard to school buses. As a reminder to school bus drivers, the procedure for crossing railroad tracks, from the U.S. Instruction Manual, is presented. These guidelines include requesting silence from passengers when prepared to stop; shifting into neutral after the bus is stopped, with bumper clear of tracks and with a clear view of tracks; opening driver's window and service door; shifting into starting gear after it has been determined no train is approaching; looking and listening a second time, then closing door and proceeding quickly and smoothly, without shifting gears; holding the bus in position, with use of parking brake depending on waiting time, if a train is approaching; keeping bus stationary at multi-track crossing until the second track is entirely visible; proceeding if safe crossing is ensured in the case of a stopped train of malfunctioning signal; proceeding around malfunctioning crossing gate only at direction of police or railroad authority; and making a safety stop and following directions of a flagman in control of crossing. The manual emphasizes that no student loading stops should occur within 300 or 400 yd of either side of railroad tracks.

Publ: School Bus Fleet v24 n2 p37-8 (Apr-May 1979)

1979 ; 4refs

Availability: See publication

HS-026 082

### TRANSPORT STATISTICS GREAT BRITAIN 1967-1977

A comprehensive range of statistical information is tabulated on inland surface transport in Great Britain covering the period 1967-1977; some data span shorter or longer periods, and some are forecasts. to provide a wider setting for the inland surface transport statistical information, some summary tables on air and sea transport are included as are key transport figures relating to other countries. Metric units are generally used; a notes/definitions section gives detailed explanatory notes appropriate to the tables; a subject index is provided. Tables and maps are presented in the following parts (and sections): general (expenditure, travel, long-distance travel, freight transport); road expenditure and network; road traffic; motor vehicle stock and new registrations; car ownership; public road passenger transport; road goods transport; driving licenses and tests; vehicle tests; railways; accidents; inland waterways; sea transport; air transport; oil and petroleum pipelines; international; and miscellaneous (energy; forecasts of national road traffic, total inland freight, and passenger transport; pollution; employment; overseas travel and tourism; motor vehicle offenses).

Department of Transport, Directorate of Statistics, 2 Marsham St., London SW1P 3EB, England

210p refs

Prepared in cooperation with Scottish Devel. Dept., Welsh Office, and other government departments.

Availability: Her Majesty's Stationery Office 5.75 pounds

HS-026 083

### THE SPECTRUM OF SEAT BELT INJURIES

A review is presented of seat belt injury types, the degree of severity ranging from minor contusions and lacerations to rupture and transection of vital structure. Intra-abdominal, genitourinary tract, thoracic, musculoskeletal, and miscellaneous (very uncommon injuries such as those to a major blood vessel) injuries are described; diagrams and texts point out lower trunk (lateral and posterior anterior views) symptoms and possible causes, and abdominal organs and possible injuries. Case histories are presented for two young men who were belted rear-seat occupants at the time their vehicle struck a pillar supporting an elevated railroad. Both men sustained abdominal injuries requiring surgery. A concluding remark advocates the use of restraint systems by all car occupants and calls for the development of better safety systems in the future. Editor's supplementary comments deal with proper adjustment of seat belts (with specific mention of quick-release buckles that pop open under certain conditions). Federal Motor Vehicle Safety Standards for restraint systems, and a physician's comment on the injury potential of restraints.

by Herbert Dardik; Ibrahim M. Ibrahim

Publ: Lawyer's Medical Journal v6 (2d) n1 p59-75 (May 1977) 1977; 55refs

Availability: See publication

HS-026 084

### SILICONE BRAKE FLUID: ANSWER TO CORROSION

Silicone-based brake fluids meet brake engineers' requirements (stability for the life of the vehicle, noncorrosivity, a high boiling point unaffected by atmospheric conditions, and the lowest possible viscosity at -40 degree F) and offer the promise of eliminating replacement of hydraulic components for the life of the vehicle. The slight shrinkage of brake system seals associated with unformulated silicone fluids has been overcome through the addition of additives in small amounts. The automotive industry has been justifiably cautious in their approach to silicone-based brake fluids, as current fluids have served adequately. For fleet owners, doubling or tripling the life of wheel or master brake cylinders could result in significant savings. The U.S. Army, Dept. of Transportation, and silicone manufacturers have long been involved in the continual improvement and exhaustive testing of silicone-based formulations. Dow Corning Corp. has tested these brake fluids for over seven years in nearly 200 vehicles (with total mileage approaching 3 million). Testing by the Army of 1/4-ton vehicles for one year in Alaska and two years in Arizona and the Panama Canal Zone showed better performance of silicone vs. conventional brake fluids in terms of corrosion and gumming. As a result of these tests, the Army has issued MIL-B-46176 covering silicone brake fluids, and is preparing for an across-the-board conversion. The U.S. Postal Service is well on its way to complete conversion. Several private fleet owners are actively testing silicone brake fluids. A General Services Administration decision to convert is contingent upon having the brake fluid available as an option from

at least two vehicle manufacturers. The National Hwy. Traffic Safety Administration is funding a feasibility study for a long-life braking system regulation.

Publ: School Bus Fleet v24 n2 p26, 29-30 (Apr-May 1979) 1979; 3refs

Availability: See publication

HS-026 085

### TINTED WINDSHIELD INVOLVEMENT AMONG CPIR [COLLISION PERFORMANCE AND INJURY REPORT] ACCIDENTS. FINAL REPORT

The 9222 vehicles in the CPIR3 (Collision Performance and Injury Report) data set were examined for evidence that would indicate whether tinted windshields cause or prevent accidents. Windshield tint condition was known for 4185 vehicles, showing an almost even split between clear and tinted windshields. Vehicles with tinted windshields were found to be significantly underrepresented in the accident data compared to U.S. production figures (1971-1977 model years). Weighted least-squares regressions showed that the proportion of drivers having vehicles with tinted windshields increases as driver age increases, but that there are no statistically significant differences between daytime and nighttime conditions. The regression analyses results do not support the hypothesis that older drivers are negatively influenced by tinted windshields during nighttime driving. It was found that tinted windshields are associated with a variety of driver and vehicular variables believed to influence accident risk. Because of these uncontrolled, confounding variables, and because of methodological limitations associated directly with the CPIR file, it is not possible to isolate the influence of windshield tinting in accident causation or prevention. A controlled study is recommended to make such a determination, possible within the National Accident Sampling System.

by Lyle D. Filkins

University of Michigan, Hwy. Safety Res. Inst., Ann Arbor, Mich. 48109

Rept. No. UM-HSRI-79-16; 1979; 53p 4refs

Rept. for Mar-Apr 1979. Sponsored by Libbey-Owens-Ford Co. Availability: Corporate author

HS-026 086

### MEASURING VISIBILITY IN BLOWING SNOW

An electronic system that monitors visibility in blowing snow has been developed by the Forest Service, in cooperation with the Wyoming State Hwy. Dept., to help travelers avoid being stranded in blowing snow storms and to improve the safety of transportation under drifting conditions. The sensor for blowing snow is a photoelectric particle counter that produces a voltage pulse for each snow particle particle counter that produces a voltage pulse for each snow particle which passes through a 3 mm by 25 mm area normal to the wind. The sensor's pulse train is processed electronically to give voltages proportional to five-sec averages of particle frequency and diameter. These voltages are combined with the signal from an anemometer in an analog computer which simulates visual range according to the equation,  $V = 5U/F(X^2)$ , where  $V$  is the visual range in m,  $U$  is windspeed in m/sec,  $F$  is the particle frequency in number/sec through a 1 sq cm area, and  $x$  is the particle diameter in cm. Field calibration was accomplished by a comparison with closed circuit TV recording of visual range targets during drifting. The correspondence between theory and observed visual range was very satisfactory, and two such systems are now in use for traffic control in Wyoming, having proved reliable and useful during three winters.

by R.A. Schmidt

Rocky Mountain Forest and Range Experiment Station

Publ: NAS-SR-185, "Snow Removal and Ice Control

Research," International Symposium (2nd) Proceedings,

Washington, D.C., 1978 p200-7

1978 ; 15refs

Symposium held in Hanover, N.H., 15-19 May 1978. Sponsored in part by Wyoming Hwy. Dept.

Availability: National Acad. of Sciences, 2101 Constitution

Ave., N.W., Washington, D.C. 20418

HS-026 087

**SYSTEM ANALYSIS OF THE GENERAL  
DETERRENCE OF DRIVING WHILE INTOXICATED**

A system analysis indentified factors which influence DWI (driving while intoxicated), produced a system model of DWI general deterrence, examined the sensitivity of parameters relative to system outputs such as DWI trip rate and accident rate, and assessed countermeasure approaches. It was found that any significant reduction of DWI trips or related accidents must necessarily be effected through general rather than specific deterrence. DWI general deterrence depends critically upon drivers' perceived risk of DWI trips and on the risk aversion characteristics of potential drinking drivers. relatively small changes in perceived risk of DWI are likely to produce large changes in number of DWI trips/accidents. Word-of-mouth feedback from apprehended or sanctioned drivers is not likely to result in any significant reduction in DWI trips/accidents. Increased enforcement reduces DWI trips/accidents significantly only when combined with increased information feedback of the consequences of these actions. The greatest potential for reduced DWI trips/accidents is through widespread dissemination of information emanating from effective and consistent DWI enforcement and adjudication actions. Research recommendations to supply needed information relevant to these conclusions are provided.

by Leland G. Summers; Douglas H. Harris

DOT-HS-6-01456

Publ: Human Factors v21 n2 p205-13 (Apr 1979)

1979 ; 17refs

Availability: See publication

HS-026 088

**A PLAGUE ON THESE PESTS [INCONSIDERATE/  
UNSAFE DRIVERS]**

By comparison with other European roadways, it is felt that British roads harbor some strange pests (i.e. irritating drivers); some of these obnoxious (and unsafe) driver types are described. One is the Limpet, or Bumper-Hugger, who sits inches from the bumper of the car he is following, matching the preceding vehicle's speed precisely; besides being offensive, his behavior is dangerous not only in failing to maintain a safe distance between vehicles but also in coercing the other motorist into dirving faster. The Ditherer pays far more attention to the other car occupants than to the traffic; he proceeds in fits and starts and does not use signals. The Road Hog charges into the safe distance between two cars in order to avoid oncoming traffic, and causes other drivers to brake heavily; he also flashes his headlights when he thinks the vehicle in front is holding him up. The Pig in the Middle, the driver who insists on occupying the middle lane at moderate speed, seems to be the pest who causes most trouble. The Litter Bug, the most widespread pest, is the driver or passenger who treats the highway like an unending trash can; he not only desecrates the environment, but also poses a threat to animals and persons on the roadside.

by Colin Dryden

Publ: On the Road v2 n1 p19-21 (Spring 1979)

1979

Availability: See publication

HS-026 090

**BIORHYTHMS AND TRAFFIC ACCIDENTS**

A critical look at biorhythm theory, in particular its applicability to personal driver safety, is provided. The theory states that there are three fixed cycles in a person's life, each starting at the moment of birth (23-day physical, 28-day emotional, and 33-day mental cycles), and that each person is likely to perform well in the up phases, poorly in the down phases, and to be most vulnerable on the critical day, the midpoint of each cycle. These critical days are claimed to be most likley to be associated with accidents. Most information available about biorhythm theory is found in a book entitled "Is This Your Day?" by George Thommen, containing examples of studies mostly connected with accidents. Lack of convincing evidence for the theory; its shaky origin, being based on a German physician's subjective interpretations of mystical numbers; and the theoretical assumptions involved (that rhythms are invariant and start at the moment of birth) provide good reason for the skepticism that exists among the scientific community. The main advantages of the biorhythm theory seem to be the provision of extra income for an increasing number of entrepreneurs, and the satisfaction of its believers' need for "knowing" the future.

by Lala Mycielska

Publ: On the Road v2 n1 p26-8 (Spring 1979)

1979 ; 3refs

Availability: See publication

HS-026 091

**NATIONAL TRENDS IN BICYCLE ACCIDENTS**

Two sets of data were collected and analyzed to estimate U.S. trends in bicycle accidents for the period 1973-1976. The first data source is the National Electronic Injury Surveillance System which contains data supplied by a national sample of hospital emergency rooms regarding visits due to product-associated accidents. The second data source comprises reports of 646 in-depth investigations of bicycle associated accidents conducted by the Consumer Product Safety Commission during 1962-1976. It was found that the type of injury and the population injured did not vary substantially over the time period involved. Similarly, the number of bicycle accidents did not increase significantly. With regard to product failure cases, it appears that a voluntary manufacturers' standard (Bicycle Manufacturer's Assoc./6) has reduced the incidence of frame failure; its possible effects should be investigated further.

by J.D. Flora; ●r.d. Abbott

Publ: Journal of Safety Research v11 n1 p20-7 (Spring 1979)

1979 ; 9refs

Sponsored by Bicycle Manufacturers Assoc. of America, Inc.

Availability: See publication

HS-026 092

**EVALUATION OF PRODUCT SAFETY TEST  
METHODS: PROTECTIVE HEADGEAR**

To demonstrate the effects of differing amounts of realism, the real-life simulation of head impacts (using a humanoid head-form) was compared with a nonrealistic test method (using a

rigid metal headform). Impact velocity was the same for both configurations; impact surface was varied in hardness to represent different (football) playing surfaces. The primary readout system was a Severity Index (SI) Analyzer that computed the resultant acceleration and gave a digital readout of the SI and peak acceleration. Using SI criteria, a mathematical relationship was developed for the pass/fail thresholds of the real-life simulation and the test method. Calculations were made on the efficacy of the test method in terms of acceptable levels of discrimination of unsafe products (i.e. protective headgear such as football helmets), as well as the false alarm rate (rejection of safe products). The evidence suggests that test procedures using metal headforms correlate sufficiently well with real-life simulations using humanoid headforms to permit their use in consumer product safety testing.

by Robert E. Berger; Nicholas J. Calvano  
 Publ: Journal of Safety Research v11 n1 p14-9 (Spring 1979)  
 1979 ; 14refs  
 Availability: See publication

HS-026 093

### **PROXY MEASURES IN ACCIDENT COUNTERMEASURE EVALUATION: A STUDY OF EMERGENCY MEDICAL SERVICES**

The necessity of establishing a relationship between a proxy measure used to evaluate a safety countermeasure and the ultimate objective of the countermeasure (reduction in accident frequency and severity) is demonstrated. Such a relationship is established for one severity-reduction countermeasure, emergency medical services (EMS), using Alabama accident data. The proxy measure utilized is ambulance response time, which is found to be related to fatality reduction. Additional analyses by time of day, day of the week, and month of the year demonstrate how additional information can be obtained using the proxy measure. Other proxy measures might be sought that, individually or in combination with delay time, could lead to greater insights into more effective EMS resource allocation.

by David B. Brown  
 Publ: Journal of Safety Research v11 n1 p37-41 (Spring 1979)  
 1979 ; 6refs  
 Sponsored by Alabama Office of Hwy. and Traffic Safety.  
 Availability: See publication  
 1979 ; refs  
 Sponsored by American Bar Assoc., Health Resources Administration, and Ford Foundation.  
 Availability: See publication

HS-026 095

### **THE CONGRESS NEEDS TO REDIRECT THE FEDERAL ELECTRIC VEHICLE PROGRAM. REPORT TO THE CONGRESS BY THE COMPTROLLER GENERAL OF THE UNITED STATES**

This evaluation of the Dept. of Energy's (DOE) program to develop, demonstrate, and commercialize electric vehicles (EV'S) addresses the potential for EV'S to conserve oil and achieve other environmental objectives, DOE'S implementation of the three major program segments (vehicle demonstration, research and development, and incentives for small business). Applicable legislation, reports, and planning documents were reviewed, and interviews were conducted with program managers within DOE and other organizations carrying out program responsibilities, officials of other government agencies, and rep-

resentatives of the automobile and battery industries and EV producers. Although it is concluded that EV'S represent a technology meriting continued development, today's vehicles have limited commercial potential because they cost more and perform less efficiently than conventional vehicles. It is recommended that EV research and development be strengthened, that vehicle demonstrations be limited initially to the Federal sector, and that loan guarantees for commercial production be delayed. The Congress should make the legislative and other changes needed for program redirection. (A letter dated 10 Jan 1978, from DOE to the General Accounting Office, commenting on a draft of this report, is appended.)

by Elmer B. Staats  
 General Accounting Office, Comptroller General of the United States  
 Washington, D.C. 20548  
 Rept. No. EMD-79-6 ; 1979 ; 67p refs  
 Availability: General Accounting Office, Distribution Section, Room 1518, 441 G St., N.W., Washington, D.C. 20548

HS-026 096

### **ESTIMATES OF MAXIMUM ELECTRIC FIELD STRENGTHS IN THE AUTOMOBILE ENVIRONMENT**

Strong electromagnetic (EM) energy sources are examined and estimates made of maximum EM field conditions to which automobiles could be exposed. The results are intended to alert automotive engineers to potentially hazardous EM radiation that might upset on board electronic control devices. The strong EM sources fall into the broad categories of broadcast radiation (AM, FM, TV and Mobile), microwave satellite communication and energy beaming, microwave radar (pulsed fields), high-voltage overhead power transmission line, and transients (radio flash) due to lightning and EMP (electromagnetic pulse) from nuclear explosions. Various expressions relating electric field strength (E) to distance from the source, transmitter power, antenna characteristics, etc., and a few supporting measurements are presented, as well as the maximum E for the automobile environment: For all common failure modes (e.g. thermal overload, burn out, dielectric breakdown, malfunction, bit error, and dropout), the strength E should be a realistic indicator of direct and indirect degradation energies. The conversion of the ambient E field into meaningful currents and voltages at the on-board electronics level has been a major difficulty and more research is needed to assure safe operation and to avoid costly overdesign.

by H.J. Liebe; ●d.d. Crombie  
 National Telecommunications and Information Administration,  
 Inst. for Telecommunication Sciences, Boulder, Colo. 80303  
 Rept. No. NTIA-79-16 ; 1979 ; 34p 22refs  
 Availability: Corporate author

HS-026 097

### **DIESEL BUS PERFORMANCE SIMULATION PROGRAM. FINAL REPORT**

A diesel bus performance computer simulation program provides information on acceleration, velocity, horsepower, distance traveled, and fuel consumption as a function of time from the originating station. Although the program was written for diesel engine operation, heat engines other than diesel may be substituted. Fuel economy calculations using the program agree well with available measurements on urban buses and may be considered representative of a baseline urban bus. Component submodels and vehicle coefficients have been carefully struc-

tured to represent current urban buses. A general description of the simulation program, the type of input data required, and results obtained by simulating a typical transit bus are provided.

by Glenn Larson; Harry Zuckerberg  
Transportation Systems Center, Cambridge, Mass. 02142  
Rept. No. UMTA-MA-06-0044-79-1; DOT-TSC-UMTA-79-16 ;  
1979 ; 204p 6refs  
Rept. for Mar 1977-Apr 1979.  
Availability: NTIS

HS-026 099

### **THE CRASHER PAPERS: NOTES FROM THE DROP ZONE. SOMETIMES A LITTLE HURT CAN HELP [MOTORCYCLE ACCIDENT STATISTICS]**

Some preliminary results are described of a study being conducted by the Univ. of California, under the sponsorship of the National Hwy. Traffic Safety Administration, which is investigating 899 motorcycle accidents occurring in Los Angeles during the past two and one-half years. More than half of the accidents studied involved riders between the ages of 16 and 23; and although women constitute only 2% of the motorcycling population, they accounted for 3.8% of the accidents in the study. Of the accident victims, 65% were not wearing helmets, 38% stating that they did not expect to have an accident. Over 494 of the accident victims did not have a standard motorcycle license. The average street-riding experience was nearly three years, but more than half the involved motorcyclists had less than five months experience; less than 10% had any formal motorcycle training. The 12% of riders using alcohol or drugs accounted for almost half of the fatalities; an equally small group who had more than four traffic violations in the previous two years represented 24% of the fatalities. In 45% of the accidents, a motor vehicle turned left into the path of a motorcycle, with visibility of the motorcycle a contributing factor. In evasion maneuvers, most motorcyclists tend to overbrake the rear and underbrake the front wheel, have increased reaction time over other motorists, and steer improperly. Misunderstanding of motorcycle dynamics which require an initial steering motion away from the intended direction, plays a large role in the accident victim's inability to react properly. When the rider hits the ground, full leathers are the best means of deceleration. Increased conspicuity (e.g. use of head lights at all times), wearing of helmets, thorough motorcycle training, and improved licensing procedures are advocated.

by Merry MacTavish  
Publ: Cycle Guide v13 n6 p64-6, 75 (Jun 1979)  
1979 ; 1ref  
Availability: See publication

HS-026 100

### **RV'S [RECREATIONAL VEHICLES]--THE COSTS OF OWNERSHIP**

The costs of four modes of recreational travel (motor home, car and travel trailer, truck camper, and private automobile/motor hotel) are examined to compare the economics of self-contained recreational vehicle (RV) use vs. lodging and travel by car. Annual fixed (ownership) and daily variable (operating) cost estimates are compared for three RV types; average daily costs of transportation and lodging using a standard car (including a prorated share of ownership costs) are estimated. Estimates are based on results of interviews with RV dealers, repair shop supervisors, service mechanics, actual owners, and or cost figures obtained from insurance executives, banking loan officers,

municipal authorities, campground managers, RV manufacturers, and various publications. A critical observation emerging from the analysis challenges the notion that RV owners are somehow "coming out ahead". In order for this to be true, the number of travel days per year would have to exceed the breakeven points of 335, 127, and 86 days, respectively, for the truck camper, the motor home, and the car and travel trailer. Few persons with full-time jobs are able to take that much time off for recreational use. The returns for RV owners must be found in intangibles such as expanded range of vacation opportunities, getting "back to nature", and sociability of fellow travelers. Indications are that the cost of owning and operating self-contained RV'S will continue to rise more rapidly than alternative modes of transportation and lodging. Consideration must also be given to possible stiff taxation on low-mileage vehicles and future gasoline rationing.

by F.B. Green  
Publ: Consumers' Research Magazine v62 n5 p16-9 (May 1979)  
1979  
Availability: See publication

HS-026 101

### **THE ELECTRICS ARE COMING! [ELECTRIC CARS]**

Electric car development is increasing in the U.S., with manufacturers introducing all sorts of new models and stepping up research, and with the Federal government planning to spend \$160 million between now and 1986 on electric vehicle (EV) research. General Motors unveiled one of its most advanced electric cars in 1978, the Electrovette (a modified Chevette), is now developing a highly advanced zinc nickel battery for future models, has several electric cars under test; and has just started making electric vans for American Telephone and Telegraph. General Electric (GE) has completed an experimental subcompact the Centennial Edition, with 60-mph and 75-mi-range ability. GE, along with Chrysler, is designing two other models for delivery to the Dept. of Energy (DOE) in 1979. Electric Auto Corp. (Detroit) plans to lease 300 units of its new electric model, the Silver Volt, to Fort Lauderdale, Fla., residents in a test program, and to install a system of quick-charge stations for everyday driving. If the program works, the company will go into production near the end of 1980; Electric Auto also plans to build an electric limousine Cadillac. U.S. Electricar Corp. has unveiled its 'Lectric Leopard which features an easy-to-plug in outlet for recharging. The Long Island Lighting Co. has just installed 40 more electrics in its fleet as a part of a DOE project, and is believed to be one of the world's major operators of electrics on public roads. The National Aeronautics and Space Administration has developed a nickel-zinc battery which offers possible 100-mi range

by Ed Janicki  
Publ: California Highway Patrolman v43 n2 p12-4, 44 (Apr 1979)  
1979  
Availability: See publication

HS-026 102

### **EUROPEAN BICYCLE SAFETY METHODS. THE WEST GERMAN WAY**

The German education system incorporates a "Jugendverkehrsschule" or youth traffic school as a regular part of its fourth grade curriculum. The textbook used is the "die Radfahrprüfung", a bike textbook similar to a driver's manual, which prepares students for a written test on bicycle safety. There is also

an instructor devoted exclusively to traffic safety tutoring. The near-zero rate of bicycle accidents among German children within the local area resulted in this system being adopted on a modified basis by the American elementary school at Hahn AFB, in the Hunsrueck area of West Germany. The school has adopted the German bicycle safety course and goals, condensed into a one-month period, and is taught to fifth graders. Receiving instruction from a member of the AFB'S Security Police Squadron, students are first introduced to the parts of a bicycle and required safety features. The initial theoretical portion of the course is presented, including a section on traffic laws and German traffic films, and a 40-point written test administered. Regardless of his test score, each student advances to the driving or practical portion of the program, taught by a German police officer who is an expert in traffic safety. Four separate traffic situations are taught, each on a different day, in a safe, school environment. In order to receive a passing grade, each student must complete the four exercises with a maximum of five mistakes. Students who complete the course receive a certificate and safety sticker for their bicycle. For the American school system as well as for German students, a near-zero bicycle accident rate indicates the success of the safety program.

by Paul K. Kahl, Sr.

Publ: California Highway Patrolman v43 n2 p16-7, 53 (Apr 1979)

1979

Availability: See publication

HS-026 103

**DRIVER IMPROVEMENT--IMPROVEMENT OF DRIVING BEHAVIOR OF PARTICULAR MOTOR VEHICLE DRIVERS. EXPERIENCE AND THEORETICAL CONSIDERATIONS (DRIVER IMPROVEMENT--VERBESSERUNG DES VERKEHRSVERHALTENS AUFFALLIGER KRAFTFAHRER. BISHERIGE ERFAHRUNGEN AND THEORETISCHE GRUNDLAGEN)**

As part of a research project to develop appropriate rehabilitation measures for problem drivers in Austria, the theoretical foundation behind driver improvement, and international experience with driver rehabilitation are examined. Driver improvement measures as an extension of driver screening, and the provisions of Section 101 of Austria's Highway Code regarding driver competency are considered. Driving behavior as a learned behavior is analyzed; the role of feedback and reinforcement on behavior, types of behavior-regulating feedback to drivers (driving instruction, criticism by other drivers, punitive action by authorities for traffic violations, accidents and near accidents); and the effect of negative reinforcers (i.e. accidents and violations) on driving behavior are treated. The detection of problem drivers is discussed in terms of the relationship between a driver's traffic record and accident involvement, and the point systems (for traffic violations) in West Germany and the U.S. A summary of driver improvement measures, a comparison of different driver improvement group courses in the U.S., and an outline of driver improvement initiatives in German-speaking countries are provided. A critical evaluation is made of existing group programs for driver improvement, and the applicability of various forms of therapy to driver improvement is analyzed. A model plan is presented for the detection and rehabilitation of problem drivers in Austria.

by L. Schmidt; A. Schutzenhofer

Publ: Zeitschrift fur Verkehrsrecht v22 n8 p250-5, n9 p279-88, n10 p312-7 (1977)

1977; 65p 68refs

Translated from German reprint (original 22p; translation 43p).

Research sponsored by Federal Ministry of Science and Res. (austria), Federal Ministry of Youth Welfare (Austria), and Jubilee Fund of the Austrian National Bank.

Availability: Reference copy only

HS-026 104

**MOTORCYCLE HELMET USE IN RELATION TO LEGAL REQUIREMENTS**

Helmet use by motorcyclists was observed in late 1978 in cities of six states with varying legal requirements regarding helmet use. In two cities (Baltimore and Miami), in which all motorcyclists are legally required to wear helmets, virtually all riders wore helmets. In three cities (New Orleans, Phoenix, and Houston) where helmet laws requiring use by all motorcyclists were changed in 1976 or 1977 so that use is mandatory only for those persons under the age of 18, wearing rates were 39%, 46%, and 63%, respectively. In Los Angeles, which has never had a mandatory helmet use law, 46% of motorcyclists wore helmets. Based on these survey results, and on the known efficacy of helmets in reducing motorcyclist injuries, the repeal of helmet laws that occurred in 26 states in 1976-1978 can be expected to result in major increases in motorcyclist deaths in succeeding years.

by Allan F. Williams; Marvin J. Ginsburg; Phyllis F. Burchman  
Insurance Inst. for Hwy. Safety, Watergate 600, Washington, D.C. 20037

1979; 9p 9refs

Availability: Corporate author

HS-026 105

**LET'S REFRESH ON ALIGNMENT: 'CONSUMERS' VS. 'CROOKS' [WHEEL ALIGNMENT PRINCIPLES]**

The basic principle of each front wheel alignment factor and the working relationship among these factors are explained for the wheel alignment specialist, including some inspection and adjustment tips. The following basic factors are discussed and illustrated: caster (forward or rearward tilt of the ball joints from a vertical line when viewing vehicle from the side), camber (inward or outward tilt of the front wheel from a vertical line when viewing vehicle from the front), toe-in (difference in distance between front and rear edges of front tires when viewed from topside of vehicle), toe-out on turns (degree difference in turning angle of two front wheels), king pin inclination (a locating of the ball joints so that they are "offset" from the vertical when viewed from the front of vehicle), and included angle (king pin inclination and camber together). Camber (and side to-side difference), caster (and side-to-side difference), and toe-in specifications are provided for the purposes of diagnosis for warranty repairs or customer paid service, periodic motor vehicle inspection, and resetting alignment. It is pointed out that of all front wheel alignment factors, toe or toe-in is probably the most important because of its immediate effect on tire wear. The importance is emphasized of checking a vehicle's riding height before checking or adjusting alignment, and making caster/camber adjustments only when necessary.

by Herb Carrier

Publ: Tire Review v79 n4 p52, 54, 56-8 (Apr 1979)

1979

Availability: See publication

HS-026 106

### THE NSC [NATIONAL SAFETY COUNCIL] BIKE INSTRUCTOR SEMINAR: HELP FOR THE ROAD'S MOST VULNERABLE USERS

The National Safety Council's (NSC) 15-hour bicycle safety instructor seminars prepare individuals to teach not only the NSC All About Bikes Prog. (a comprehensive, six-hour course to give children the framework for wise bicycling), but also the 4-H Club and Club Scout bicycle training courses. The instruction is usually given on two days, broken down into four phases: a five-hour, classroom session in which the All About Bikes Instructor Manual is used as the basic text, supplemented by 4-H and Cub Scout Leaders guides; a two-hour session on bicycle maintenance and repair; a two-hour practice of the Skilled Driving Contest in which the instructor trainees actually practice the maneuvers they will teach their students; and a four hour session during which each of the student instructors takes turns teaching for from three to ten minutes. The eight skilled driving exercises cover balance ability, speed and slow speed coordination, decreasing space maneuvering, decreasing serpentine balance and steering, right or left evasion, and left and right spiraling. The final two hours are devoted to a "rap session", after which certificates of completion are presented. An important factor in the bicycle instructor seminar program is the inherent multiplying effect. In the fall of 1978, the NSC Youth Dept. sent questionnaires to 405 graduates (about half the total). Of the 61 who responded, more than 90% said that the instruction was sufficient to make them feel competent about teaching bicycle safety; each respondent was found to have taught, on the average, almost seven classes (215 per class). So far, 143 graduates of the seminar program have become certified instructor trainers. The seminars are organized by a "local catalyst" (e.g. safety council, police department, service club, PTA) who contacts the NSC's Youth Dept. The basic fee is \$13.50 per student; each class should have 25 to 50 students; equipment needed is a movie projector and at least three bicycles.

by Robert B. Overend

Publ: Traffic Safety v79 n4 p8-10, 28-9 (Apr 1979)  
1979 ; 1ref

Availability: See publication

HS-026 107

### MINNESOTA TELLS PUBLIC: "REAL PROS DRIVE 55...SAVES GAS! SAVES LIVES"

In 1978, the Minnesota Safety Council, the Minnesota Dept. of Public Safety, and the Minnesota Energy Agency, initiated a public education campaign on the 55 mph speed limit, with a theme of "Real Pros Drive 55...Saves Gas! Saves Lives!". Three 30-sec TV spots were produced featuring champion professional racing drivers, and three more spots with national champion professional over-the-road truck drivers (provided by a cosponsor, the Minnesota Motor Transport Assoc.) which conducted a parallel campaign supplying literature and bumper stickers to its members, and forms to citizens for reporting speeding truckers). The highlight of the "Real Pros" campaign was in Jan 1979, when "The Minnesota Challenge" was broadcast throughout the state (estimated 120 million viewers), a half-hour energy-saving driving quiz program based on a Honeywell-produced film entitled "Featherfoot". Newspapers, magazines, and company publications published the program announcement and a quiz form and TV spots announced availability of forms; quiz forms were distributed to high school students as part of a home study assignment. Based on a major 1977 campaign on the 55 mph speed limit, billboard use was increased to 100 locations. The

campaign slogan was used at public facilities and events. Eight prints of the "Featherfoot" were in constant circulation. An attitude questionnaire published in newspapers received a 50.58% extremely favorable response and 31.79% somewhat favorable response to the 55 mph speed limit; 48.41% responded that speeding was extremely important, and 30.79% stated that it was very important, in causing crashes; 72.11% believed that driving 55 mph saved gas, and 76.38% believed that it saved lives; but the majority believed that most people drove between 60 mph and 65 mph. Speed statistics for 1978 show that the "Real Pros" campaign assisted in holding speeds to a lower level than they had been in all years prior to 1977; but crashes and fatalities increased in 1978.

by Robert L. Anderson

Publ: Traffic Safety v79 n4 p14-5, 30 (Apr 1979)

1979

Availability: See publication

HS-026 108

### WHY NOT USE DRIVER LICENSE EXAM TO SCREEN FOR HEALTH PROBLEMS?

Dr. Patricia Waller, associate director for driver studies at the Univ. of North Carolina's Hwy. Safety Res. Center, proposes a low-cost, collaborative effort between driver licensing and public health agencies. The effort would involve using driver license programs to screen persons for the detection of certain health problems shown to be associated with poor driving (e.g. hypertension, diabetes), to refer those driver license applicants with problems to medical experts, and to follow-up the licensed drivers automatically every four years through renewal license procedures. The driver-related decisions would remain with the licensing authorities, while health and social service decisions would be made by appropriate professionals. The incorporation of such a screening program could be justified on licensing grounds; the relationship between hypertension and driving, for example, may prove to be more direct than that between vision and driving. (Vision screening is already a part of evaluation procedure for original licensure.) Departments of motor vehicles could also work cooperatively with state health professionals to control the problem driver. Health professionals and social services experts should play a major role in providing driver improvement analysts or state hearing officers (who frequently represent the first official personal contact with the department of motor vehicles for problem drivers) with information on community resources which could be used as additional alternatives to traditional driver improvement measures.

Publ: Traffic Safety v79 n4 p18-20, 30-1 (Apr 1979)

1979

Reprinted from a recent issue of Highway Safety Highlights  
(published by Univ. of North Carolina, Hwy. Safety Res.  
Center)

Availability: See publication

HS-026 109

### ACCIDENT INVESTIGATION--WHO CHECKS THE SHOCK ABSORBERS

Statistics accumulated over several years through independent tests and those from car clinics carried out by the European Shock Absorber Manufacture's Assoc. (EuSAMA) have shown that about one in three cars of testable age have one or more shock absorbers in a dangerous state of repair. Shock absorber wear is caused by outer-tube corrosion, damage by debris thrown up from the road, internal valve fatigue, and especially



by deterioration of the oil seal resulting in hydraulic fluid loss. The wear and failure ratio is 60% on front axle, 40% on rear. EuSAMA classifies shock absorbers as dangerous when they are operating at 40% below original equipment figures. Shock absorber danger signs include hydraulic fluid on outside of absorber, loose absorbers, damaged end rubbers, badly corroded units, and bent piston rods (following accident damage). Worn shock absorbers affect headlight alignment, braking distance, and tire adhesion, in addition to ride and handling. Additional vibrations caused by worn shocks can cause car sickness and driver fatigue, can shake loose electrical components, wear tires unevenly, and wear out universal and drive joints and steering components more quickly. A suggested checklist for use by police at roadside safety checks includes observing the vehicle in motion (bouncing, lopsided attitude, headlight misalignment), bouncing the four corners of the car (check oscillations), and checking underneath vehicle for danger signs. The inclusion of shock absorbers in the Ministry of Transport Test in the U.K. in 1977 will do a great deal to eliminate worst cases, and has already resulted in increased shock absorber sales.

by John Wardle

Publ: Journal of the Institute of Automotive Engineer Assessors  
v13 p4-7 (Winter 1977-1978)  
1978

Availability: See publication

HS-026 110

### **CAR REAR IMPACTS AND THE NEED FOR HEADREST**

An analysis by the Transport and Road Res. lab., (TRRL, England) of 1971 road accident data for Great Britain showed that 5.5% (153) of fatal and 7.2% (2652) of serious car occupant casualties involved cars damaged in the rear. Of these casualties, almost 20% were rear-seat occupants who, according to other studies, had little need of headrests; over half of those injured in front seats were asymmetrically impacted from the rear, and narrow headrests might not have protected them. In 21 serious or fatal injury accidents investigated by TRRL which involved cars or vans struck in the rear, 7 out of 41 occupants suffered whiplash injuries, representing less than a quarter of front-seat occupants. A study by the Southern and Midlands Road Safety Units in 1969 found that 80 neck injuries occurred in 117 less serious rear-impact accidents. It is estimated that about 3% of all car occupants involved in rear impacts to their cars will suffer slight neck injuries (5% of all slight injuries) resulting in somewhat greater economic loss than for other slight injuries. Whiplash injuries from rear impact are thought to be somewhat greater than 5% of slight injuries. Detailed studies by TRRL have shown that whip lash injury does not correlate with extent of damage from rear impact. Whiplash injuries are caused by hyperextension of the neck, and are more likely to be serious for older people. Most experts consider headrests, high seat backs, etc., as means of preventing such injuries. A cost/benefit analysis suggests that the fitting of two extended seatbacks or headrests would have to cost 1 pound to equal benefits.

Publ: Journal of the Institute of Automotive Engineer Assessors  
v13 p8-9 (Winter 1977-1978)  
1978

Availability: See publication

HS-026 111

### **SAFETY EVALUATION OF PRIORITY TECHNIQUES FOR HIGH-OCCUPANCY VEHICLES. FINAL REPORT**

Research focused on five major areas of high-occupancy vehicle (HOV) priority treatment projects: an examination of the pertinent accident rates, an analysis of causative factors influencing safety, an identification of difficult maneuvers and potential safety problems, the development of recommendations to improve safety, and a review of the legal authority and legal liability issues faced by HOV projects. Twenty-two HOV projects on 16 highway facilities were visited: Shirley Hwy., Fairfax Co., Va.; San Bernadino Freeway, Los Angeles; Moanalua Freeway, Honolulu; Santa Monica Freeway, Los Angeles; Route 101, Marin Co., Calif.; I-95, Miami; I-495, approach to Lincoln Tunnel, Hudson Co., N.J.; Long Island Expressway, New York City; ramp metering bypass ramps, Los Angeles; I-5, Seattle; San Francisco-Oakland Bay Bridge Toll Plaza, Oakland; Washington, D.C. central business district streets; U.S. 1/South Dixie Hwy., Miami; Kalaniana'ole Hwy., Honolulu; N.W. 7th Ave., Miami; and Ponce de Leon/Fernandez Juncos Avenues, San Juan, Puerto Rico. These projects encompass every type of preferential treatment strategy currently employed in the U.S. on both freeways and arterial facilities. For each HOV project, data on safety, operations, and geometrics were collected and analyzed. These data and qualitative information can be used to describe the current experience relating to the HOV safety issue.

by Craig Miller; Robert Deuser; Joseph Wattleworth; Charles Wallace

Beiswenger, Hoch and Associates, P.O. Box 600028, North Miami Beach, Fla. 33160; University of Florida, Transportation Res. Center

DOT-FH-11-9182

Rept. No. FHWA-RD-79-59; 1979; 194p refs

Rept. for Oct 1976-Dec 1978.

Availability: NTIS

HS-026 112

### **ENGINEERING GUIDELINES FOR THE ANALYSIS OF TRAFFIC-INDUCED VIBRATION. FINAL REPORT**

Guidelines are presented for assessing the potential for adverse environmental impact resulting from seismic vibrations induced by highway traffic. Vehicle/pavement interaction, propagation of vibration, response of building structures, and evaluation criteria are presented in quantitative engineering terms. Abatement strategies, measurement, and analysis of traffic-induced vibration are discussed. Example problems and analyses are presented for pavement surface roughness, vehicle speed, and vehicle gross weight, the main parameters in traffic induced vibration. The details upon which the guidelines are based are found in a parent report, FHWA-RD-78-168, "Determination of Impact from Vibrations Related to Highway Use," which documents a study to define the nature and extent of traffic-induced problems.

by F.F. Rudder, Jr.

Science Applications, Inc., Energy and Environmental Sciences Div., 1651 Old Meadow Rd., Room 620, McLean, Va. 22101

DOT-FH-11-8494

Rept. No. FHWA-RD-78-166; 5-451-00-288-00; 1978; 146p

38refs

Rept. for Jun 1974-Jun 1977.

Availability: NTIS



HS-026 113

**THE SURFACE TRANSPORTATION, ASSISTANCE ACT OF 1978**

The Surface Transportation Assistance Act of 1978 (P.L. 95-599), signed into law on 6 Nov 1978, is the first act to combine authorizations for highways, highway safety, and public transportation in one piece of legislation, and the first act related to Federal-aid highways to authorize funds for a four-year period. Total funding provided in the act is \$51.4 billion to become available in fiscal years 1979 through 1982, with \$30.6 billion for highways, \$7.2 billion for highway safety, and \$13.6 billion for public transportation. The most significant provisions include extension of the Hwy. Trust Fund as the major source for highway and highway safety program funding for five years (30 Sep 1979 to 30 Sep 1984), as well as extension of existing taxes; stimulation of accelerated completion of the Interstate System; promotion of more effective safety and bridge programs; restructuring and refocusing of transit assistance; and program changes to promote greater flexibility.

Department of Transportation, Washington, D.C. 20590  
1978? ; 46p  
Availability: Federal Hwy. Administration, Office of Public Affairs, 400 7th St., S.W., Washington, D.C. 20590; Urban Mass Transportation Administration, Office of Public Affairs, 400 7th St., S.W., Washington, D.C. 20590

HS-026 114

**FRONT DRIVE SYSTEMS FOR FOUR-WHEEL DRIVE LIGHT TRUCKS**

The major components unique to light-truck four-wheel drive (4x4) systems and their effect on vehicle performance are reviewed. The tractive capabilities of four-wheel drive are compared with front and rear driver under various load, grade, and friction conditions. The effects of different types of inter-axle differentials are examined, and the advantages and disadvantages of various front suspension and drive systems for 4x4's discussed. Although significant technological advances have been made in the development of 4x4 systems, numerous aspects of current systems, such as ride, handling, cost, ease of operation, and fuel efficiency, compare unfavorably with their two-wheel drive counterparts.

by Martin J. Hermanns  
Dana Corp., Spicer Front Drive Systems Div.  
Rept. No. SAE-SP-437 ; 1979 ; 23p 11refs  
Presented as 25th L. Ray Buckendale Lecture.  
Availability: SAE

HS-026 116

**AUTOMOTIVE SAFETY--THE NEED TO KNOW**

It is emphasized that the consumer needs to be aware of present automotive safety standards and statistics in order to select a vehicle and equipment that will provide the greatest safety to him and his passengers. The greatest difference among vehicles in terms of occupant protection is related to vehicle size and weight. Statistics show a 3-to-1 ratio of death or serious injury to occupants of small cars over those of large cars; one study found that serious injury occurred twice as often when a small (compact) car collided with a small car as when a large car collided with a large car. It is questioned whether the fuel-saving 800 lb and 1000 lb weight reductions of new cars will offset the more sophisticated design for improved structural integrity and adversely affect the protectiveness of even the

bigger cars. The consumer should be informed of the protection, comfort, and convenience afforded by the various restraint systems. The appeal of passive restraint systems is noted; because of their automatic operation, they eliminate many consumer information problems and require limited consumer cooperation. It is emphasized that these systems require honest, straightforward presentation and promotion, including mention of their disadvantages (e.g. initial and replacement cost of air bags, and force of blast on deployment). The need for more highway crash data on the effectiveness of air bags and passive belt systems is emphasized. The failure of Federal Motor Vehicle Safety Standard 121 (antilock brake systems for trucks and buses) because of inadequate evaluation in actual trucking service is cited, emphasizing the need for the consumer to insist that regulatory proposals remain proposals until field trials have been conducted. Automotive safety and safety regulation information on a much wider scale needs to be published to aid the consumer.

by Roy C. Haeusler  
Rept. No. SAE-SP-435 ; 1978 ; 9p  
Ralph H. Isbrandt Memorial Lecture.  
Availability: SAE

HS-026 117

**PERFORMANCE OF ALUMINUM AUTOMOTIVE RADIATORS**

Field performance of flux-brazed aluminum automobile radiators removed from cars after service periods as long as ten years show aluminum to be a viable construction material. Data representing service experience dating back to the early 1950's indicate that properly designed radiators, adequately cleaned to remove brazing flux, offer a high degree of structural integrity. Extended, trouble-free service can be expected when cooling systems are maintained and the coolants added according to manufacturers' recommendations. With increasing usage of road salt during winter months, significant external corrosion of thin-wall tubes has been observed, but improved protective systems, now available or being developed, will substantially minimize the corrosion problem. Field experience with repair systems is limited, but laboratory tests indicate the availability of adhesive systems that should be adequate for repairing damaged radiators. Protective coatings are recommended for both metallic (lead tin) and adhesive (epoxy) repaired areas.

by William King; ●w.c. Weltman  
Alcoa Labs.  
Rept. No. SAE-790400 ; 1979 ; 8p 2refs  
Technical Paper Series. Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 118

**PERFORMANCE EVALUATION OF A VERSATILE TWO-CYCLE LUBRICANT ADDITIVE**

Test data show that the performance of a new two-cycle additive (Additive A) is at least equivalent to the current Boating Industry Associations (BIA) TC-\*W Reference Oil in water-cooled outboard engines operating on a variety of leaded fuels under a wide range of test conditions. Air-cooled engine performance was superior to the TC-\*W Reference Oil in high-temperature ring sticking, and exhaust-port blocking, and the new additive system appeared to be effective in preventing piston scuffing during BIA TC-\*W Phase I conditions. Additive A can be used to formulate TC-\*W oils containing no bright

stock. Limited lead-free fuel testing showed similar cleanliness and performance of Additive A. In certain high-output engines operating at 65:1 fuel-air ratio, it was found necessary to add 12% bright stock to the formulations to prevent piston scuffing and bearing wear. At 50:1 or less fuel-air ratios, no bright stock is required. The evaluation resulted in extensive test development using a large variety of two-cycle engines; this was necessitated by the lack of standardized certification procedures for air cooled, two-cycle lubricants. The BIA'S TC-W test, although adequate to evaluate two-cycle oil performance in large-output outboard engines, cannot be expected to evaluate lubricants satisfying all engine types and operating conditions. Current efforts by the Society of Automotive Engineers, and the American Society for Testing and Materials to establish a meaningful two-cycle engine oil classification system are endorsed.

by D.L. Clason; ●w.m. Nahumck

Lubrizol Corp., Res. Dept.

Rept. No. SAE-790080 ; 1979 ; 15p 6refs

Technical Paper Series. Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.

Availability: SAE

#### HS-026 119

### SAFETY OF MULTIPURPOSE VANS. SPECIAL STUDY

An investigation of 18 low-to-moderate speed crashes involving multipurpose vans was undertaken in order to determine injurious effects on occupants of custom interior furnishings and structural modifications, because certain existing Federal Motor Vehicle Safety Standards (FMVSS'S) do not apply to vans. The safety of vans was evaluated from the standpoints of injury-producing environment, occupant restraint, crashworthiness, postcrash fire, and ease or difficulty of escape. FMVSS'S 201, 202, 203, 204, 212, 214, 215, and 216 were evaluated in terms of these five main area of investigation. Inadequately secured or unsecured appliances, seats, and furnishings were found to have contributed to serious injuries and deaths. Securement of appliances and furnishings by wood screws, nails, or other fastenings is often inadequate to retain equipment in place during an accident. Custom highback bucket seats ("captain's type") failed in three cases and caused occupant injuries. Custom steering wheels caused injuries to several drivers and probably one driver death; some drivers were injured when they hit production steering wheels/columns. It is not clear that FMVSS'S 203 and 204 can be directly extended to vans. Restraint systems were not available or not used, partially accounting for a high number of ejections and severe-to-fatal injuries. Ten out of 19 vans did not retain their windshields on impact, resulting in five occupant ejections; FMVSS 212 applies only to forward-control vans. In five accidents, a van overrode a passenger car, resulting in four car occupant fatalities. Twenty percent of the doors jammed, not resulting in escape problems but posing a potential hazard. In six van models, not required to meet FMVSS 206, 17 doors opened at impact, while only two doors meeting the standard opened. No evidence was found of excessive passenger compartment compression, nor of adverse effects by custom windows on crashworthiness. Neither was there evidence that injury reducing features of FMVSS 201 (Interior Impact) would not have been effective in minimizing injury.

National Transportation Safety Board, Bureau of Plans and Programs, Washington, D.C. 20594

Rept. No. NTSB-HSS-79-1 ; 1979 ; 47p 7refs

Availability: NTIS

#### HS-026 120

### CHILDREN IN CRASHES: A SPECIAL ISSUE

Several current activities are reported involving hazards to children in motor vehicle especially, hazards to unrestrained children. The National Hwy. Traffic Safety Administration (NHTSA) regional workshops on child restraints are described; the first of these is planned for Atlanta in Mar 1979; the objective is to marshal grassroots support for increased protection for children in cars. Mention is made of NHTSA rules, to be issued in the summer of 1979, that will require dynamic crash testing of child restraints at speeds up to 30 mph, using specified test dummies. Although only one state now has a child restraint law in force (Tennessee), it is reported that proposed bills for such legislation have already been introduced in 11 states in 1979 and are expected to be filed in at least seven more states. A response by the Insurance Inst. for Hwy. Safety (IIHS) to an inquiry from a state motor vehicle administrator recommends necessary elements of an effective child restraint use law, and provides information on children in crashes. A cited study by the Univ. of Michigan's Hwy. Safety Res. Inst. (HSRI) found that many of currently used restraint systems for protecting handicapped children in school bus collisions are inadequate. A research project supported by IIHS demonstrated the inability of adults to restrain children adequately in their laps by holding on to them. Mention is made of a Dept. of Transportation order to review flammability standards for school bus interior materials. An IIHS-SUPPORTED study conducted by Johns Hopkins Univ. found that infants as motor vehicle occupants have an extremely high death rate compared to older children. The ineffectiveness of an Australian child restraint publicity campaign is reported. A letter to NHTSA from the IIHS concerns Renault's misinterpretation of Head Injury Criterion data from a free-fall study conducted by HSRI under IIHS sponsorship.

by Margaret Heckard; John Reichard; Rea Tyler; John Walker

Publ: Status Report v14 n5 p1-16 (19 Mar 1979)

1979 ; refs

Includes HS-026 121.

Availability: See publication

#### HS-026 121

### UNSAFE AT ANY AGE? CHILDREN AND CAR SAFETY

Facts are reported about child involvement in motor vehicle crashes, with special emphasis on the importance of properly using appropriate child restraint systems. Various studies are cited which have demonstrated the effectiveness of child restraints in reducing injuries and fatalities in motor vehicle crashes, the number one cause of death for children over the age of one. Various statistics indicate the infrequent, and generally incorrect, usage of child restraint systems. It is recommended that in the absence of a child restraint device, small children should be made to use regular lap seat belts with the seat belt across the top of the child's thighs. Older children should use both lap and shoulder straps. The safest location is in the middle of the back seat. While an adult seat belt restraint is better than none, the first and best choice for a small child is an approved child restraint because it is designed to meet his special needs in a crash. Four types of child restraints include an infant carrier, a protective shield, a traditional car seat, and a safety harness. The Tennessee mandatory child restraint usage law exempts older children and allows parents to hold their children, a dangerous practice. The National Hwy. Traffic Safety Administration's proposed new testing and performance requirements for child restraints, and its regional child restraint workshops are mentioned. A "no excuses" safety guide for parents, and statis-

tics from NHTSA'S Fatal Accident Reporting System on characteristics of accidents involving child fatalities, are outlined in separate sections.

by Stewart Alter  
 Publ: HS-026 120, Status Report v14 n5 p8-12 (19 Mar 1979)  
 1979 ; 1ref  
 Reprinted from Parents Magazine (Feb 1979).  
 Availability: See publication

HS-026 285

### BRIDGING THE GAP BETWEEN DEXRON-II AND TYPE F ATF [AUTOMATIC TRANSMISSION FLUIDS]

An automatic transmission fluid (ATF) has been developed which can meet the needs of transmissions designed for either friction-modified or nonfriction-modified fluids. Approved under General Motors' DEXRON-II and Ford's M2C138-CJ specifications, it also meets the requirements of Ford's M2C33-F (Type F) specification except for the friction modifier content. The DEXRON-II/CJ fluid did not show any signs of clutch plate damage or band slippage when tested in transmissions designed for Type F fluid. The tests included severe, 8000-cycle vehicle and dynamometer tests and special vehicle dynamometer tests run by Ford. In actual field practice, DEXRON-II fluids are being added to transmissions designed for Type F ATF. Conversely, Type F fluids are being added to transmissions designed for DEXRON and DEXRON-II is superior to that of Type F ATF. As measured by the Turbo Hydramatic Cycling Test, the oxidation stability of Type F fluids ranges from nearly equivalent to significantly poorer than DEXRON-II requirements. It is believed that a specification designed around the DEXRON-II specification can be developed to describe a service station ATF that will be suitable for automotive automatic transmissions which now require DEXRON, DEXRON-II, Type A Suffix A, or Type F ATF. Test results are appended.

by H.E. Deen; R. O'Halloran; ●e.f. Outten; ●j.p. Szykowski  
 Exxon Chemical Co.  
 Rept. No. SAE-790019 ; 1979 ; 16p 11refs  
 Technical Paper Series. Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.  
 Availability: SAE

HS-026 286

### AUTOMOTIVE TECHNOLOGY PROJECTIONS

Results of an automotive technology assessment study are presented to provide a basis of comparison for vehicles with alternative power systems. The following engine types are examined: Otto (uniform-charge (UC), rotary UC, stratified-charge (SC), rotary SC), diesel (naturally-aspirated, turbocharged), free-turbine Brayton (metal, ceramic), single-shaft Brayton (metal, ceramic), and Stirling (metal, ceramic). Factors considered include fuel economy, exhaust emissions, multifuel capability, advanced materials, and cost/manufacturability for both convention and advanced alternative power systems. To ensure valid comparisons of vehicles with alternative power systems, the concept of an Otto-Engine-Equivalent (OEE) vehicle is utilized. Each engine type sized to provide equivalent vehicle performance. Fuel economy projections are made for each engine type considering both the legislated emission standards (0.4 g/mi hydrocarbons, 3.4 g/mi carbon monoxide, 1.0 g/m nitrogen oxides (NOX)) and possible future emissions requirements (0.4 g/mi NOX). The sensitivities of the fuel economy projections to

factors such as engine torque boundary, rear axle ratio, performance criteria, and engine transient response are discussed Using the OEE vehicle concept, projected fuel economies of both small- and full-size vehicles with Stirling engines are up to 40% better than baseline vehicles with conventional engines. Vehicles with Brayton engines show up to a 30% better fuel economy than the baseline in full-sized vehicles, but offer little fuel economy advantage in small vehicles. Advanced continuous combustion power systems (Brayton and Stirling) offer advantages over the baseline vehicles in the areas of exhaust emissions and multifuel capability, but their initial costs are projected to be substantially higher.

by M. Dowdy; A. Burke  
 California Inst. of Tech., Jet Propulsion Lab., Pasadena, Calif.  
 Rept. No. SAE-790021 ; 1979 ; 20p 46refs  
 Technical Paper Series. Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979. Research sponsored by Dept. of Energy.  
 Availability: SAE

HS-026 287

### SMALL CAR SAFETY IN BIG-CAR COUNTRY

The safety aspects of roadside appurtenances which have been developed during the past ten years are reviewed, as well as those of systems currently under development and test. These systems, developed through research sponsored by the Federal Hwy. Administration, the states, and the private sector, are basically fail-safe systems designed to reduce fatalities, personal injury, and property damage in low- and high-speed impacts by either small or large-size passenger cars. The following categories of roadside appurtenances are covered (photographs of the fail-safe systems provided): luminaire supports, utility poles, roadside sign supports, overhead sign bridge structures, protective median barriers, impact attenuators at exit ramps, forgiving bridge rails, construction zone safety devices, railroad/highway grade-crossing environment improvements and impact attenuators, and tollgate facility impact attenuators.

by F.J. Tamanini  
 Energy Absorption Systems, Inc.  
 Rept. No. SAE-790294 ; 1979 ; 21p refs  
 Prepared for presentation at Congress and Exposition, Detroit, 1 Mar 1979.  
 Availability: SAE

HS-026 288

### EFFECT OF MAIN FACTORS ON DYNAMIC PROPERTIES OF MOTORCYCLE TIRES

Results are presented and discussed from a laboratory study undertaken to clarify how various tire conditions, such as internal pressure, load, make, width, tread pattern, and tread curvature, and the drum curvature of the testing machine, influence the dynamic properties of motorcycle tires. The importance of tire dynamic properties in predicting the dynamic properties of motorcycles, and the indispensability of the control of tire dynamic properties for the improvement of motorcycle performance are considered. It was found that tire dynamic properties (cornering stiffness, camber stiffness, side force (camber thrust), overturning moment, self-aligning torque) are significantly influenced by the various tire and drum factors. It is hoped that the beneficial data obtained may contribute to future improvement in motorcycle dynamic properties as well as in tire dynamic properties.

by Hideo Sakai; Osamu Kanaya; Hiromi Iijima  
Japan Automobile Res. Inst., Inc., Japan  
Rept. No. SAE-790259 ; 1979 ; 16p 2refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 289

### MOPED DIRECTIONAL DYNAMICS AND HANDLING QUALITIES

A comparison of moped and motorcycle design features related to directional handling is presented. Design parameter values are given for four sample mopeds (typical moped, moped with the appearance of a small motorcycle, moped with swing-arm front suspension, and moped with front-wheel drive (fork-mounted motor)), in comparison to those of a lightweight street motorcycle. Analytical results describing the sample mopeds' lateral-directional dynamics are provided. Using a nominal moped example, the sensitivity of the vehicle dynamics to operational and design variables, such as speed, loading, and tire properties, is shown. Implications for rider/moped handling are reviewed. Comparison of the four example mopeds with a lightweight motorcycle and other street machines shows that the mopeds generally have response modes similar to motorcycles, but that mopeds can be twice as sensitive to roll-to-steer torque gains at nominal operating speeds, requiring more precise control and attention, and reduced inadvertent control activity. Factors are outlined which reduce moped stability in the capsize, weave, and wobble modes.

by John W. Zellner; David H. Weir  
Systems Technology, Inc., Hawthorne, Calif.  
DOT-HS-7-01719  
Rept. No. SAE-790260 ; 1979 ; 16p 9refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 290

### SIMULATION OF OFF-ROAD MOTORCYCLE RIDE DYNAMICS

Previous work on vehicle ride dynamics applicable to motorcycles is reviewed, and the basis discussed for a four-degree-of-freedom (bounce, pitch, and movement of each wheel) computer simulation of the dynamic ride response of a motorcycle. The simulation is nonlinear in terms of both geometry and suspension components, and is generally applicable to any type of motorcycle of reasonably standard configuration. It was developed in the context of application to off-road motorcycles, and special problems associated with simulating these machines are discussed. Some numerical results are presented which indicate that the dynamic response is strongly nonlinear, with wheel lift-off and suspension bump stops as the two major sources of nonlinearity. Considering the general behavior of the stock vehicle utilized (a 1974 Kawasaki KX250 typical motor-croser), it was found that instead of two separate bounce and pitch natural frequencies, one general resonance at around 5 cps occurred, indicative of the strong coupling between bounce and pitch for this vehicle. The accelerations at 5 cps were much stronger for the out-of-phase sinusoid than for the in-phase case, suggesting that a pitching motion (arising from out-of-phase case) is more uncomfortable for the rider. Recommendations are offered for improving the simulation.

by Stephen H. Black; Dean L. Taylor  
General Electric Co., Schenectady, N.Y.; Cornell Univ., Ithaca, N.Y.  
Rept. No. SAE-790261 ; 1979 ; 16p 20refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 291

### MOTORCYCLISTS' VISUAL SCANNING PATTERN IN COMPARISON WITH AUTOMOBILE DRIVERS'

Three male subjects participated in experiments in which an eye-marker method was used to compare motorcyclists' vs. drivers' visual scanning behavior. Independent variables were vehicle type and speed. The proportion of road surface in the visual field was found to be much larger for the motorcyclist than the driver of the car. Since the motorcyclist's head is tilted forward, it follows that he is apt to be looking at the near road surface more frequently. From an analysis of motorcyclist and driver fixation points, it is suggested that the motorcyclist is acquiring information mainly from the near road surface, whereas the car driver is acquiring information mainly from the distant foreground. For motorcyclists, the vertical variance of visual field and fixation points is larger, suggesting that the motorcyclist is trying to acquire information from both the near road surface and the distant foreground. Mean fixation duration of the motorcyclist is shorter than that of the car driver, suggesting that the cyclist is acquiring and identifying information relatively superficially. These findings have implications for motorcycle accidents in which the cyclist fails to detect vehicles turning left, oncoming vehicles, crossing vehicles, and pedestrians. Motorcyclists, automobile drivers and pedestrians should all be informed of these facts.

by Yasuhisa Nagayama; takanobu Morita; Toshiaki Miura;  
Junichi Watanabem; Nobuo Murakami  
Osaka Univ., dept. of Traffic psychology, Japan; Kawasaki Heavy Industry, Japan  
Rept. No. SAE-790262 ; 1979 ; 15p 7refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 292

### PRODUCT LIABILITY AND THE MOTORCYCLE DESIGNER

Recent changes in product liability law, and in the magnitude of jury awards, dictate that motorcycle designers shift their design priorities. Since a relatively recent California court decision (the Ault decision), a designer must approach development of new products, or new models of and existing product, with the full knowledge that if he creates a safer design than his company previously manufactured and sold, all previous products may be judged in accordance with the safety or performance of the new, improved version. The Barker vs. Lull decision (early 1978) effectively eliminates most of the previous burdens of proof from the plaintiff in a product liability case. To the other costs of a motorcycle design, costs of insurance and/or directly paid litigation costs must be added. If enormous "punitive damage" claims continue, which is indicated, it will be incumbent upon the motorcycle designer to consider how much exposure, or potential liability, a particular design might represent in court. If a little more money must be spent in a design to reduce potential product liability exposure, then this expense must be evaluated in light of potential financial and adverse publicity

losses in court. The astonishing increase in out-of-court settlements is related to the increasingly liberal interpretation of product liability laws by the courts, and the tremendous rise in defense costs. Product liability litigation demands serious consideration by the motorcycle designer at the concept stage and throughout final hardware development.

by Jon S. McKibben  
McKibben Engineering, Inc.  
Rept. No. SAE-790264 ; 1979 ; 8p 2refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 293

### EXPERIMENTAL STUDY ON MOTORCYCLE STEERING PERFORMANCE

Experiments on four large (650 cc to 900 cc) motorcycles of Japanese manufacture to study machine lateral motion involved analysis of pulse response, high-speed random response, and land-change response (straight or near-straight course runs), and ramp step response and slalom response (curved course runs). Results of each experiment were arranged as frequency response functions (input, output) by random signal analysis. Three primary oscillation modes (capsize, weave, and wobble) were studied. Steer torque and rider lean angle were considered as independent rider control inputs, and both single-input and dual-input analyses were conducted. The major input factor was found to be torque, with lean angle by itself having almost no influence on output.

by Akira Aoki  
Japan Automobile Res. Inst. Inc., Japan  
Rept. No. SAE-790265 ; 1979 ; 19p 14refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 294

### EXPERIMENTAL INVESTIGATION OF THE TRANSIENT BEHAVIOR OF MOTORCYCLES

Analytical and experimental studies investigated the transient and oscillatory behavior of three example motorcycles (lightweight, intermediate, and heavyweight). The effects of adding load, changing operating conditions, and modifying vehicle configuration were examined. It was found that adding a rear load of 10% gross vehicle weight can lead to weave oscillations in some cases, particularly in near-limit, steady turns where the suspension is compressed and the normal load on the tires is greater; the rear load plus the weight of the rider and instrumentation, can bottom the suspension in extreme cases. Analyses showed that adding a large, rear load can also decrease the wobble mode damping. Damping rear suspension motions can reduce or eliminate the cornering weave problem, consisting of coupled lateral and longitudinal motions in a particular speed range. Adding weight to the front fork assembly ahead of the hinge line increases the mass and steer moment of inertia; this tends to decrease both weave mode damping and natural frequency. The presence of a fork-mounted fairing transmits aerodynamic forces and moments directly to that assembly. Aerodynamics disturbances can apparently excite the wobble mode at high speed, while the corresponding no-fairing case has no wobble oscillation. The fairing tends to decrease the wobble mode frequency somewhat. Oscillatory behavior existed only when one or more of the following conditions were present:

very high speeds, adverse loadings, hands-off operation, near the limit of performance (e.g. in a high lateral acceleration, steady-state turn), and degraded components (e.g. shock absorbers). The cornering weave phenomenon tends to arise in high lateral acceleration, steady turns when the weave mode natural frequency (which is speed-dependent) is in the vicinity of the pitch mode (rear suspension) natural frequency. The lean angle is sometimes determined by ground clearance. A large steer torque pulse sometimes excites a persistent directional oscillation, not otherwise present.

by David H. Weir; John W. Zellner  
Systems Technology, Inc., Hawthorne, Calif.  
DOT-HS-6-01381  
Rept. No. SAE-790266 ; 1979 ; 20p 11refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 295

### ACCIDENT AVOIDANCE CHARACTERISTICS OF UNCONVENTIONAL MOTORCYCLE CONFIGURATIONS

Low-center-of-gravity, long-wheelbase motorcycle configurations were investigated analytically in terms of stability, obstacle avoidance characteristics, and braking performance, using mathematical models of both the uncontrolled and rider-controlled motorcycle. Both front- and rear-steered configurations were studied. The rear-steered configuration was found to have unacceptable stability and controllability characteristics; this was confirmed by tests on a buck. On the basis of the analytical results, the front-steered configuration appears to have an advantage in improved obstacle avoidance performance at other than very low speeds, with stability at least equal to a conventional machine. Another potential advantage is in reduced sensitivity of the front-to-rear brake proportioning to lateral acceleration and road conditions. Offsetting these advantages to a degree are a degradation in low-speed maneuverability and controllability, and weight and overall complexity of the machine.

by Robert Schwarz  
South Coast Technology, Inc., Santa Barbara, Calif.  
Rept. No. SAE-790258 ; 1979 ; 16p 3refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979. Research sponsored by National Hwy. Traffic Safety Administration.  
Availability: SAE

HS-026 296

### WHAT'S NEEDED TO MAKE RRIM [REINFORCED REACTION INJECTION MOLDING] A BETTER BET FOR THE AUTO INDUSTRY

The development program in RRIM (reinforced reaction injection molding) established at Ford Motor Co. in Jul 1977 to investigate the suitability of the process for molding automotive exterior body panels is described. The four main areas evaluated are equipment capability to handle reinforcing agents (monitored for relative degrees of abrasiveness, settling, and clogging characteristics); fiber reinforcements and their effect on coefficient of linear thermal expansion (CTE); processing characteristics of fiber-filled materials (viscosity, cycle time); and physical properties of the high-modulus and rigid RIM materials (automotive Class-A surface, heat sag, impact strength, CTE, fiber orientation, flexural modulus, paintability). The RRIM trials and material testing indicate that RRIM is already a feasible process

for exterior body panels requiring a Class-A surface finish. Further improvements needed in the process include internal mold release, light-stable substrates, heat stability at 400 degree F, mixing head to handle abrasive slurry, and advances in fiber technology. Future developments in the field of polyurethane (PUR) and non-PUR materials combined with milled and/or chopped fibers and other fillers could make the RRIM process a candidate for structural members.

by Michelle J. Mikulec

Publ: Modern Plastics v56 n5 p136, 138, 140, 144 (May 1979)

1979

Based on Processing Award paper presented at SPI RP/

\*COMPOSITES Inst. Conference, New Orleans, Jan-Feb 1979.

Availability: See publication

HS-026 297

### **ROADSIDE RIPOFF [DISHONEST PRACTICES BY SERVICE STATIONS]**

Advice is given to the motorist on how to combat the dishonest practices of unscrupulous service station attendants (estimated at 2%) who try to sell drivers unneeded products or services. Regular car maintenance by a reliable mechanic and learning as much about one's car as possible are recommended. When a problem is reported by an attendant, the motorist should examine the reported defect, and should act as if he understands the problem; if the mechanic uses technical jargon, the motorist should insist on a simple explanation. It is emphasized that emergency repairs should not be authorized hastily; a second opinion should be obtained if possible. A damaged tire should be changed, but a spare will probably work adequately for a short distance; a set of tires should never be bought from an out-of-the-way station. If a decision is made to have a repair done, the car owner should find out what is involved in the procedure and how much it will cost before the work is started. A signed, detailed receipt and the bad parts should be obtained. When paying for gasoline, oil, and other services, the motorist should be certain about the currency tendered, should count his change, and should walk to the credit card imprinter with the attendant and read all invoice slips carefully. If the motorist feels cheated, he should write a letter(s) to the oil company involved, an auto club, attorney general's office, and/or the state's consumer affairs office.

by Richard Bauman

Publ: California Highway Patrolman v43 n3 p16-7, 52 (May 1979)

1979

Availability: See publication

HS-026 298

### **THE USED-OIL RECYCLING PROGRAM**

To eliminate the environmental hazards of improper disposal of use motor oil, the California Legislature passed the Used Oil Recycling Act in 1977. The bill (SB 68) appropriated \$100,000 to the Solid Waste Management Board to set up collection stations for used oil, to adopt a set of rules governing the collection and disposal of that oil, and to educate the public on the merits of the reclaimed product. Solid Waste Management has now organized a network of over 2000 collection facilities (automotive service stations, auto repair shops) throughout the state where the do-it-yourself oil changer can deposit the drainings. All used-oil receiving facilities have signs posted announcing their participation, and any retailer selling motor oil for off-the-premise use is required by law to post a sign indicating the

location of a nearby collection facility. Donors are not currently paid for the used oil; collection stations receive 5 cents/gal from oil re-refiners for the used product (about 30 million gal of crankcase oil presently recycled annually). About 80% of the motor oil is currently being reclaimed, 10 million gallons as crankcase oil, 13 million gallons as fuel oil, and 6 million gallons as road oil or asphalt. Among the available reclaimed motor oils, which must meet Federal quality standards, are Mor-Lube, Rexol, and Modern. Various truck lines and taxi companies, as well as the City of San Diego, are using re-refined motor oils in their fleets. The Calif. Dept. of Transportation is conducting a test program of fleets using the recycled oils. Solid Waste Management hopes that at least half of the 80 million gal of motor oil sold annually will be re-refined.

by Pat Washburn

Publ: California Highway Patrolman v43 n3 p18, 54 (May 1979)

1979

Availability: See publication

HS-026 299

### **LEMON AID [ADVICE ON BUYING A USED CAR]**

For prospective purchasers who are not versed in mechanics, suggestions are provided for avoiding mistakes in buying a used car. The first step is to make a firm decision on type of vehicle wanted and affordable price. Among sources of used cars, consideration should be given to the newspapers' want ads, and other sources (auctions, sales lots of big car rental agencies, new-car trade-ins on dealers' lots). Dealers' warranties should be examined critically. A thorough examination should be made of a prospective purchase, including a walkaround, a drive, and a mechanic's inspection. Walkaround checks include the paint job (look for blisters, and if exterior paint matches interior spots, e.g. trunk), odometer reading (over 10,000 to 12,000 mi/yr is excessive, much less than that indicates excessive city driving), driver's seat and pedals (if newer than car, could indicate rough use of vehicle), tires (for even wear, and matching), shock absorbers (bounce test), latches (locked and unlocked), brake pedal, under the hood (especially for leaks), and engine-start conditions (gauges and lights on panels, abnormal sounds, color of exhaust). The driving test checks include steering wheel play; gear changing for automatic and manual transmissions; wheel alignment (check for turn-in, turn-out, or wobble while someone else is driving); firmness of accelerator, brake pedal, and clutch; and working order of all controls, signal lights, buzzers, and gauges. The final inspection should be by a reliable mechanic.

Publ: Driver v12 n12 p14-6 (May 1979)

1979

Availability: See publication

HS-026 300

### **A PUCKER FACTOR HIGHER THAN SEVEN [HAZARDOUS DRIVING SITUATIONS AND HOW TO HANDLE THEM]**

Ten risky driving situations are described and various ways to handle them are provided in a multiple-choice quiz (with the best answer provided and explained). The following types of situations are covered: right-side wheels dropping off pavement and onto a sharply-dropping shoulder when forced off the road while driving legal speed limit on four-lane highway; an oncoming car on a two-lane highway attempting to pass without knowing there are two cars to overtake instead of one; momentary blinding by an oncoming car with high beams; car stalled on a railroad crossing with a train coming; unexpectedly ap-

proaching a bridge covered by a thin film of ice; going too fast for a particular curve; lighted cigarette falls from hand and rolls under seat; brakes fail when going 30 mph down a hill in a business district and approaching traffic signal that has just turned red; rounding a curve on a 55-mph, two-lane country road only to find a bull slowly walking across the road not 100 ft away; and driving on the inside lane on a four-lane undivided city street with traffic on both sides when the car jerks forward once and comes to a stop.

Publ: Driver v12 n12 p22-7 (May 1979)  
1979 ; 1ref  
Availability: See publication

## HS-026 301

### A MICROPROCESSOR-BASED SYSTEM FOR TRAFFIC DATA COLLECTION

The design and construction are described of a system to collect traffic data and transfer them to a central computer for processing, as well as the recent use of the new system in observations of traffic behavior at T-junctions. A comparison is made with an earlier system which involved videotaping of T-junction traffic behavior, incorporating a digital clock image, analyzing the tapes in slow motion and noting the event and clock time, transferring the output (a list of events and times to the nearest tenth of a second) to punched cards, and analyzing by computer. The new microprocessor-based system was sought to reduce the time and effort required by using data input manually by observers and data from automatic sensors. The data collection equipment is the Golden River mk4 system, a modular system based on a microprocessor. It has facilities for using random access memory and programmable read-only memory, a real-time clock, a number of input and output facilities, and its own power supply. Analysis of traffic data using this system is comparatively easy and much quicker than video techniques. The accuracy of the data is limited by the accuracy of observers in a real-time situation. The equipment, although fairly bulky, is portable; a second smaller version is being designed. The system could be used for other data collection purposes and could be adapted for many computing tasks.

by P. C. Storr; Jenny Wennell; M. R. C. McDowell; Dale F. Cooper  
Publ: Traffic Engineering and Control v20 n4 p156-8 (Apr 1979)  
1979 ; 8refs  
Sponsored by Transport and Road Res. Lab. (England).  
Availability: See publication

## HS-026 302

### LABOUR-SAVING METHODS FOR COUNTING TRAFFIC MOVEMENTS AT THREE-AND FOUR-ARM JUNCTIONS

Mathematical analysis demonstrates how the suitable placing of automatic traffic counters can reduce the number of traffic observers required for recording vehicle turning movements at intersections. Equations are derived and applied for traffic counts at three- and four-arm junctions. Three options are studied for a crossroads situation; it is assumed that the proportion of traffic from one road turning right is known, that the proportion of traffic from one road that goes straight onto another road can be estimated or that the proportion of traffic from one road that will turn left can be estimated. It is shown that by an appropriate choice of option and use of local knowledge (e.g. that there is no right turn) or historical data, good estimates, even 100% accurate results, may be obtained, using fewer than

one observer per arm at an intersection. It is shown that if a certain value cannot be estimated, its value can be limited to a practical range and hence the largest practical range of values can be found for the traffic flow.

by M. L. Marshall  
Publ: Traffic Engineering and Control v20 n4 p159-62 (Apr 1979)  
1979  
Availability: See publication

## HS-026 303

### A ROAD TRAFFIC SIMULATOR EMPLOYING MICROPROCESSORS

A new hardware/software road traffic simulator employs microprocessors in a parallel configuration. Each of two microprocessors simulates the performance of each intersection in a traffic network with a further microprocessor as an overall controller. With each one of the set of microprocessors operating essentially in parallel, organizational problems are minimized, and overall speed is no longer a function of network size. The degradation of speed as the network size increases is minimal. Input and output of traffic data are facilitated through the use of a mini-computer equipped with visual display unit and cartridge-disc store to which the hardware model is attached as a special-purpose peripheral. This approach facilitates overall control and the application of appropriate traffic signal control policies. If simulation speed is high, it also provides the possibility of predictive control policies. Cost considerations have restricted the model to a small size, although the modular structure allows easy expansion.

by M. G. Hartley; G. Bevilacqua  
Publ: Traffic Engineering and Control v20 n4 p172-6 (Apr 1979)  
1979 ; 6refs  
Availability: See publication

## HS-026 304

### TURBOCHARGING: WHAT DOES THE FUTURE HOLD?

Various approaches and options in the design of automotive turbochargers are discussed. The movement to backswept impeller blades in the new small units is considered. Means of avoiding overboosting the engine at high engine speeds (exhaust wastegate, adjustment of the turbine nozzle flow area) are outlined. Two-stage turbocharging (i.e. two turbo units placed in series) is mentioned as a design option. The Hyperbar system is cited as an example of an approach to maintaining high turbo speeds by the use of exhaust augmentors or combustors. The application of turbocharging, and associated problems, to diesel passenger cars and gasoline engines are discussed. It is felt that if low-priced turbochargers become available in mass production for the gasoline engine, they will undoubtedly be used on many passenger car diesels. Technical work in progress relates to turbocharger reliability and installation, fuel system control, boost pressure control, increasing low-speed boost, and reducing turbo lag. Placement of the throttle before or after the turbocharger compressor in a gasoline engine and its effect on compressor efficiency are discussed. A comparison is provided of the advantages and disadvantages of positioning the carburetor either upstream or downstream of the compressor section.

Publ: Automotive Engineering v87 n6 p26-30 (Jun 1979)  
1979  
Based on papers included in HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines."  
Availability: See publication



HS-026 305

### AERODYNAMIC DESIGN BOOSTS FUEL ECONOMY AND ROOMINESS

Design of General Motors' 1980 front-wheel-drive X-cars demonstrates that substantial fuel economy improvements can result from aerodynamic studies at the beginning of the design cycle. Fuel economy gains from aerodynamic drag reduction are equivalent to a weight loss of about 118 kg via downsizing or lightweight material substitution. The average coefficient of drag of the 1980 X-cars (0.442) is 0.070 lower than the average of 11 domestic and import family-type cars measured, and only 0.016 higher than the average of eight sports cars. The aerodynamic drag force (proportional to drag coefficient times frontal area) of the 1980 X-cars also compares favorably with the same 11 family-type cars. The lower drag coefficient and frontal area of the 1980 Chevrolet Citation 4-door hatchback vs. the 1979 Nova 4-door sedan result in a saving of 1.4 mpg composite fuel economy at a level of 25 mpg. Improvement in aerodynamic drag (1.2 mpg) is the largest source of mpg improvement other than the 363 kg weight reduction. The improvements were quantified in a computer simulation, "GPSIM." The aerodynamic program had five basic stages, beginning with the development of a basic overall appearance theme of the car compatible with low aerodynamic drag. Both 1/4- and full-scale clay models of each X-car division (Chevrolet, Pontiac, Oldsmobile, and Buick) were tested, followed by tests on prototype and pilot line cars. Pros and cons of testing quarter-scale and full-scale models are tabulated. After wind tunnel testing, each of the prototypes was given a coastdown test. The three-year program ended with a coastdown testing of pilot line cars. Four other design goals involving aerodynamics were ample radiator flow for engine cooling and minimizing electric fan running time, reduced wind noise at windshield pillar and side mirrors, minimum side glass contamination from road splash, and adequate ram air ventilation of the passenger compartment.

Publ: Automotive Engineering v87 n6 p35-41 (Jun 1979) 1979

Based on SAE-790724 "An Effective Aerodynamic Program in the Design of a New Car," by Lloyd Nedley. See also HS-026 306 and HS-026 307.

Availability: See publication

HS-026 306

### CHEVROLET DESIGNS AND BUILDS A NEW V-6

The Chevrolet Div. of General Motors (GM) was assigned design and manufacturing responsibility for a v-6 powerplant which would provide optional extra power and performance for GM's 1980 x-car program. The engine is currently available in the Olds Omega, Buick Skylark, and Pontiac Phoenix, as well as the Chevrolet Citation. The 60 degree v-6 engine is placed transversely in the vehicle, with the flywheel on the driver's side. Since vehicle packaging was established by the time a firm decision was made to design an optional engine, the engine compartment dimensions were well-defined, adding space constraints to the other reasons for a 60 degree bank angle. Overall width of the engine with accessories is 657 mm or 101 mm less than that of the Chevrolet 90 degree v-6. Overall engine length is 536 mm; the electrically-driven cooling fan is mounted to the radiator support structure, rather than the engine. Although cast iron was used for both block and heads, the design philosophy was to minimize weight. The v-6, 2.8-L engine is tuned to deliver 86 KW (115 hp) at 4800 rpm and 196 N.m (145 lb. ft) at 2400 rpm, the actual torque curve being flat and broad. Because of the shape of the power curve, wide-open-throttle shift speeds with automatic transmission are calibrated to 5300 rpm, 500 rpm

over the peak, but a speed which delivers greater vehicle acceleration. The vehicle, equipped with v-6 and automatic transmission, is estimated to deliver 20 mpg city, 30 mpg highway, and 23 mpg combined.

Publ: Automotive Engineering v87 n6 p42-50 (Jun 1979)

1979; 1 ref

Based on SAE-790697 "The General Motors 2.8 Liter 60 degree v-6 Engine Designed by Chevrolet," by David A. Martens. See also HS-026 305 and HS-026 307.

Availability: See publication

HS-026 307

### GM ACHIEVES FUEL ECONOMY VIA SYSTEMS ANALYSIS

techniques for optimizing fuel economy in the design of General Motors' 1980 front-wheel-drive X-cars involved reduction of road load and parasitic losses combined with powertrain matching to the vehicle as a system. Initial parametric studies, using the GPSIM simulation program in the concept definition stage, indicated many fruitful areas for fuel economy improvement (e.g. reduction of aerodynamic resistance, tire rolling resistance and brake drag; optimization of gearing). Using GPSIM, each component of the vehicle and the power transmission system was analyzed to determine accurately the effect of a change in that parameter on fuel economy. Optimization of the vehicle as a system required that the most influential subsystems have characteristics which could be relied on to perform predictably in the final car in order to avoid mismatching of powertrain parameters to the vehicle. Target characteristics affecting economy and performance were defined, usually preceding the actual design. With definition of basic vehicle parameters (e.g. frontal area, weight distribution), and with targets for mass, aerodynamic drag, and tire losses, powertrain matching analyses were made of transmission gearing, torque converter characteristics, final drive ratios, and engine displacement requirements to meet performance targets. Each component was also examined to minimize its parasitic losses. The result of the fuel economy optimization program is the base engine 1980 X-car with automatic transmission having a composite fuel economy rating of 26.7 mpg, a 37% improvement over the 1978 X-car (19.4 mpg), while about 3.6 mpg were gained directly from reduced size and weight, the remaining 3.7 mpg resulted directly from road load and parasitic loss decreases and powertrain optimization.

Publ: Automotive Engineering v87 n6 p52-7 (Jun 1979) 1979; 1 ref

Based on SAE-790721 "Design for Fuel Economy--The New GM Front Drive Cars," by F. C. Porter. See also HS-026 305 and HS-026 306.

Availability: See publication

HS-026 308

### AN UNCOOLED, UNLUBRICATED DIESEL?

High-performance ceramic materials may eventually permit designers to omit cooling and lubrication system from heavy-duty diesel engines. If current research and development programs are successful, it may be possible to produce an uncooled diesel engine of high thermal efficiency in conjunction with turbocompounding. Through the use of turbocharging to compensate for decreased volumetric efficiency, and a turbocompounding device to convert the increased exhaust energy of a hot adiabatic engine to useful power, improved thermal efficiencies result. With the hot adiabatic engine concept, the cooling system is completely eliminated. The minimum-friction unlubricated engine may be made possible with high-performance ceramic



but according to Cummins Engine Co. and the U.S. Army Tank Automotive Res. and Devel. Command, no present high-performance ceramic can fulfill all the required properties for the diesel engine. zirconia and lithium aluminum silicate glass ceramics feature low cost and ease of process control, but lack the high strength required for the diesel. A laboratory adiabatic diesel engine has been designed and built around Cummins' six-cylinder NH engine in order to demonstrate technical feasibility of an adiabatic turbocompound engine of advanced ceramic design. Three cylinder builds of the basic engine were made, each emphasizing different materials (metallic, hot press silicone nitride (HPSN), and glass ceramic). The high-strength, high-temperature true capability of HPSN offers the best chance of success during preliminary feasibility demonstration.

Publ: Automotive Engineering v87 n6 p59-61 (Jun 1979)

1979 ; lref

Based on SAE-790645 "Ceramics in Heat Engines," by R. Kamo and W. Bryzik.

Availability: See publication

HS-026 309

## FRICION MODIFIERS TAILOR BRAKE AND CLUTCH CHARACTERISTICS

New requirements for friction lining materials exist because of the elimination of asbestos in brake and clutch compositions and the use of small pads for downsized and compact cars. Research on solid friction control additives at Dow Corning Corp. has produced new technology by which friction and wear properties can be tailored to specific requirements. Compositions of phenolic resins (binder in friction composites) with high loading of molybdenum disulfide, MoS<sub>2</sub> (European use as friction modifier) and Dow Corning's Friction Modifier "A" were tested on an Alpha LFW-1 friction and wear testing machine. Addition of either friction modifier provided a reduction in wear and friction; the resin with "A" gave generally lower initial coefficients of friction and wear values and changed less with time. Friction Modifier "A" gave a more constant coefficient of friction with changes in speed, load and time. At higher speeds and lower loads, no difference in wear was apparent between MoS<sub>2</sub> and "A". Good correlation was found between LFW-1 test results for three different brake compositions (Class A, high in asbestos and organic components; Class B, less asbestos and organic components plus some inorganic components; and Class C, semimetallic nonasbestos composite) and their general characteristics. Class C gave the most stable frictional properties, but also produced the most noise. Addition of 10% Friction Modifier "A" to Class C resulted in more consistent coefficient of friction properties between 600 and 1200 rpm, and less noise. Comparisons between the new friction modifier and MoS<sub>2</sub> in brake pad Compositions during dynamometer testing showed the following advantages for the new additive: lower noise, less dependence of friction coefficient on temperature, decreased wear of brake pad (30% increase in lifetime), and decreased wear of metal disc.

Publ: Automotive Engineering v87 n6 p74-6 (Jun 1979)

1979

Based on SAE-790717 "Controlled Friction Additives for Brake Pads and Clutches," by Harry M. Schiefer, and George V. Kubczak.

Availability: See publication

HS-026 310

## AIRBAG GAS GENERANT SIDE EFFECTS STUDIED

The all-chemically-generated gas system (pyrotechnic) of air bag restraint systems (ABRS) contains sodium azide as the propellant. Unburned sodium azide is apparently toxic to humans, animals, vegetation, and microorganisms in small concentrations; long-term effects are not well-known. When the compound burns, it produces harmless nitrogen and small amounts of strongly alkaline substances, which in normal air bag deployment do not reach the passenger compartment. The DL-\*Z113 propellant based on sodium azide is classified as a Class C explosive. The hybrid ABRS uses stored gas (argon) supplemented by propellant (potassium perchlorate with polyvinyl chloride and carbon black). The dosages of this propellant resulting in adverse health effects are much higher than any intake which might occur with its use in air bag inflators. Unwanted combustion products, including carbon monoxide, occur when potassium perchlorate is burned. The manufacture of the various gas generant chemicals should require no more than routine precautions. Besides the toxicity of the generants and products during normal deployment, other ABRS use considerations are exposure during theft, mounting add-on equipment, or replacement after crash. Concerning salvage operations, it appears that the ABRS would be left alone or deliberately deployed rather than removed. Of the disposal options (baling, shredding, and large-scale furnace melting), shredding appears to present the greatest potential hazard.

Publ: Automotive Engineering v87 n6 p82-4 (Jun 1979)

Based on SAE-790640 "Selected Aspects of Gas Generants Research," by J.T. Herridge; SAE-790643 "The MVMA Gas Generants Investigation," by Serge Gratch and Carl C. McConnell; and SAE-790641 "An Investigation of the Potential Human and Environmental Impacts Associated with Motor Vehicle Air Bag restraint Systems," by Lawrence J. Partridge, Jr., and G. Stewart young.

Availability: See publication

HS-026 311

## FUEL HOSE PERMEATION: AN EMISSIONS PROBLEM?

New fuel hose material with improved resistance to degradation, volume increase, and permeation by aliphatic/aromatic fuels will be required as regulations decrease the amount of allowable hydrocarbon (HC) and fuel compositions change. Immersion tests were conducted to study the effects of temperature, hydroperoxide (formed by reaction of HC fuels with oxygen, "souring" of gasoline), and catalyst concentration on physical properties of such current fuel hose construction materials as fluorocarbons, epichlorohydrin (ECO), and nitrile (NBR). Permeation tests were conducted on these hose materials using fluid A which represented the maximum anticipated aromatic content of current and future automotive fuels, and fluid B which was representative of the current unleaded aromatic fuels. During immersion testing, a bisphenol-cured fluoropolymer and a diamine-cured fluoropolymer showed excellent resistance to "sour" gasoline. In permeation testing, thin diaphragms of Viton GH fluorocarbon elastomer (FKM-1) had low permeation rates in fluid A, which decreased with increasing elastomer thickness. Still lower permeation rates were found for fluid B. ECO underwent reversion during immersion testing in "sour" gasoline. Diaphragms of Hydrin 100 (ECO-1) had good resistance to permeation in fluid A; after 21 days, samples had a weight loss equal to about 19% of total fuel, compared to 40% fuel loss for the best NBR compound tested and 22% and 25%

for Hydrin 200 copolymer (ECO-2) and Hydrin 400 copolymer (ECO-3), respectively. Fluid B permeation rates were considerably lower in comparison. NBR underwent additional vulcanization in immersion in "sour" gasoline. Diaphragms of NBR-1 (Chemgum HR-765 with sulfur cure) had high permeation rates in fluid A, with NBR-2 (Chemgum HR-765 with peroxide cure) having higher rates. Permeation characteristics for fluid B were similar. Overall, equilibrium permeation rate was far lower for FKM-1

Publ: Automotive Engineering v87 n6 p86-8 (Jun 1979)  
1979

Based on SAE-790657 "Automotive Fuel Permeation Resistance: A Comparison of Elastomeric Materials," by J.D. MacLachlan; and SAE-790659 "Effect of (Sour) Gasoline on Fuel Hose Rubber Materials," by A. Nersasian.  
Availability: See publication

## HS-026 312

**RUN-FLAT TIRE USES DOUBLE BEAD, REINFORCED SIDEWALL**

An N-type, run-flat tire has been developed at Nissan Motor Co. Ltd. (Japan) which is used on a conventional wheel and has a simple structure with reinforced side walls and additional beads to fit rim flanges. It requires a conventional air valve and can be mounted with standard tire changers. Although the tire weighs 26% more than a conventional tire, the wheel assembly weighs only 15% more. About 6 kg can be saved per vehicle because the spare tire is unnecessary. The N-type, run-flat tire meets all requirements for the Japanese Automobile Tire Manufacturers Assoc. standards for high-speed performance and load endurance. Bench tests and vehicle testing were conducted for run-flat endurance and characteristics, cornering stiffness, steering and stability, frequency response, transient response, steering wheel effort, riding effort, and fuel consumption. The tires provide vehicle stability and mobility after tire deflation. During field testing of 15 vehicles over a total distance of 600,000 km, some punctures occurred. After running for 20 km to 120 km (average 65 km), the deflated tires were found to be normal and repairable.

Publ: Automotive Engineering v87 n6 p91-3 (Jun 1979)  
1979

Based on SAE-790668 "Development of the N-Type Run-flat Tire and Its Evaluation in Vehicle Dynamics," by Keiichiro Yabuta and Hiroaki Nishimura.  
Availability: See publication

## HS-026 313

**TRAFFIC ON UTAH HIGHWAYS 1978**

Average daily traffic volumes are tabulated on road sections of varying lengths in Utah during 1978 (and 1977 for comparison); color-coded information is provided for the state highway system, Federal-aid urban local highways, Federal-aid secondary local highways, and Federal-aid primary highways not on the state system. A manual vehicle classification summary indicates the percentages of types of vehicles (Utah passenger vehicles, out-of-state passenger vehicles, light trucks, heavy trucks) using the various highway systems. Another tabulations depicts the following traffic data from all permanently located traffic counting machines: average traffic by day of week each month, average weekday traffic by months, average day of week traffic by months, the average day percentage of the average weekday, the monthly daily average percentage of the yearly daily average, and percentage breakdown by vehicle types for the yearly

average. Unbound traffic volume maps are provided in an attached pocket.

Utah Dept. of Transportation, Travel Analysis Unit, First Security Bldg., Room 800, 405 S. Main St., Salt Lake City, Utah 84111

1979 ; 241p

Prepared in cooperation with Federal Hwy. Administration.  
Availability: Corporate author \$10.00

## HS-026 314

**RECENT TRENDS IN TRAFFIC INJURY**

A series of graphs is presented and discussed which show the changes in the nature of injuries sustained in road accidents in Great Britain over the period 1958-1975. The Register-General's Statistical Reviews of England and Wales, in which tables are based on death certificates for 1958-1975, and the Annual Report of the Hospital In-Patient Enquiry for 1964-1973, were examined. Causes of death, primary injury for hospital inpatients, and average length of hospital stay were analyzed. It seems that an increasing proportion of deaths are being ascribed to internal injuries and a decreasing proportion to skull fractures. A considerable year-to-year variation in the average length of hospital stay was noted, but no long-term trends were detected. An annotation by J. p. Bull comments on the possible relationship of increased use of helmets and seat belts, and improved clinical care, to the decreasing proportion of deaths attributed to skull fractures. A second annotation by J.M. Potter questions the accuracy of "head injury" and "skull fracture" as a cause of death on forms used by the Registrar-General and Hospital In-Patient Enquiry.

by T.P. Hutchinson; ●r.a. Harris

Publ: Injury v10 n2 p133-8 (Nov 1978)

1978 ; 5refs

Availability: See publication

## HS-026 315

**FABRICATION OF AUTOMOTIVE BODY COMPONENTS IN GRFRP [GRAPHITE FIBER REINFORCED PLASTIC]**

Procedures are described which were used by the Vought Corp. to fabricate automotive body components in graphite fiber reinforced plastic (GrFRP) for the Graphite 1979 Ford LTD. The effort was a joint venture with Milford Fabricating Co. (a subsidiary of the Budd Co.). Master tooling aid development, high-temperature epoxy molds, and component fabrication are discussed. During an eight-month period, 30 high-temperature epoxy bond-molds and 30 graphite reinforced plastic, car body components, of a highly complex configuration, were successfully fabricated. Aerospace technology and experience made a major contribution to the auto industry in this project to utilize GrFRP to reduce vehicle weight for improved fuel economy.

by W. R. Kiefer; A. L. Mills; T. p. Bellinger; G.H. White  
Vought Corp., Dallas, Tex.

Rept. No. SAE-790028 ; 1979 ; 8p

Technical Paper Series. Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.

Availability: See publication

HS-026 316

### SHORT-TERM PHASE STABILITY OF AUDIO SIGNALS IN MOBILE RADIO VEHICLE-BASE LINKS

The phase perturbation of an audio tone transmitted over conventional frequency-modulated mobile radio links at frequencies of 72MHz, and 462 MHz was investigated. Data are presented from stationary and moving vehicles in a variety of urban routes and in mountainous terrain. The effects of noise and multipath propagation are identified. Results are interpreted in light of the requirements of a particular automatic vehicle monitoring system, which is briefly described. Results indicate that, as far as the vehicle-base link is concerned, a vehicle-location system of the type described is a perfectly practical proposition. Analyses show that, even when a speech signal is only just receivable, 90% of the readings will be in error by 20 to 40 degrees, equivalent to line-of-position errors of the order of 100 m. The contribution of the radio link will generally be much less than this. In urban areas where multipath range differences are usually quite short, the phase spikes can result in very large phase errors (of relatively low probability). A location or communications system sensitive to these must contain means of detecting phase perturbations and rejecting the associated data. More severe multipath effects can occur in hilly or mountainous areas where the path differences are longer. Although, in general, the peak errors are no greater than those in the city, the overall statistics are worse because of the greater rate of occurrence and longer durations of the perturbations.

by J. David Last; Andrew J. Wade

Publ: IEEE Transactions on Vehicular Technology vVT-28 n2 p132-9 (May 1979)

1979 ; 14refs

Sponsored by Decca Survey, Ltd., Leatherhead, U.K.

Availability: See publication

HS-026 317

### FOUR DIESEL CARS: MERCEDES-BENZ 300D, CADILLAC ELDORADO, PEUGEOT 504, OLDSMOBILE CUTLASS

The pros and cons of diesel engines in general are discussed in terms of fuel efficiency, fuel availability, price, starting, acceleration, maintenance, durability and availability. The Mercedes-Benz 300D, Cadillac Eldorado, Peugeot 504, and Oldsmobile Cutlass diesel models are rated in terms of engine and drivetrain, front and rear accommodations, interior noise level, ride, normal handling, accident-avoidance ability, brakes, safety features, bumper protection, controls and displays, climate control, predicted repair incidence, periodic servicing, and miscellany. The advantages and disadvantages of each model are noted. A progress report on long-term durability testing of a 1977 Volkswagen Rabbit diesel and a 1978 Oldsmobile Delta 88 diesel is provided. Among the recommendations presented are the selection of the Mercedes-Benz 300D as the diesel of choice if money were no object (the price tag is \$21,000), and the VW Rabbit as the best buy. The Rabbit delivers the best fuel mileage of any car available and has a price tag of between \$5500 and \$6000 (some dealers demand more).

Publ: Consumer Report v44 n6 p344-8, 350-2 (Jun 1979)

1979 ; 2refs

Availability: See publication

HS-026 318

### 25 ANTI-THEFT IDEAS [AUTOMOBILE PROTECTION]

Suggestions for the car owner to prevent theft of his vehicle (99% of thefts are preventable according to police auto-theft investigators) are provided under two categories: procedures and devices. Among the procedures it is recommended to roll up the windows, lock doors, and remove keys; to keep spare keys in wallet or purse; to have different keys for ignition, doors, and trunk (giving parking attendant only the ignition key); locking in the glovebox the vehicle registration and papers showing the owner's address; taking claim checks when leaving desirable items in plan view inside a car. Suggestions for parking so as to discourage vehicle theft include parking only in a driveway with engine facing the street or in a locked garage, and avoiding dark parking places. Antitheft devices are described by type and function; they include anti-entry devices (door locks, external and internal hood locks), disabling devices (fuel shutoff, battery disconnect, brake system lock, pedal clamp, steering wheel bar, steering column band), and alarm systems (switch alarm, electrical drain alarm, motion detector alarm, pocket-pager-type alarm, coded start systems, garage alarm). Another antitheft system is the sandblasting of a code number into every piece of glass in the car, with the code kept in a central file accessible to police departments across the country on a 24-hour basis. In order to avoid a "purchase theft", it is advised not to let prospective buyer take car for a test drive by himself, and not to accept checks of any kind. As a purchaser, one should not buy a car that does not have correct paperwork, and one should compare the vehicle identification number with the number on the registration.

by Peter Frey

Publ: Motor Trend v31 n6 p65-7 (Jun 1979)

1979

Availability: See publication

HS-026 319

### ENOUGH OF YAWNING EXAMINERS AND PARALLEL PARKING [DRIVER LICENSING TEST]

various opinions about, and approaches to, driver licensing tests are discussed. The National Hwy. Traffic Safety Administration's (NHTSA) concern is to develop goals and research to improve the quality of driving and to suggest programs for the individual states to implement. Within NHTSA, there are those who feel that a driving test should be a severe test of the ability to control a vehicle, along with testing for observational ability and threat perception; others feel that the test should merely be a regulatory device and that post-licensing control is appropriate. A California driving instructor and former member of NHTSA'S Council on Advanced Driving advocates a tough licensing law, with far more emphasis on car control in driver's education courses. The chief of the Office of Traffic Safety in California believes an ability to work with vehicle dynamics should be required for a license; he also agrees with NHTSA that the major safety steps have already been taken, and that lowering the accident rate still further will require new driving attitudes on everyone's part. Since 1956, the British have been administering the Inst. of Advanced Motorists (IAM) hour and a half, 35-mile driving test (criteria listed in separate box) which demands rigorous standards of control, observation, and driving knowledge. Almost 150,000 persons have been admitted to IAM membership by passing the test, and their violation conviction rate is five times lower than that of the general public, and their accident rate 25% lower. It is estimated that if there were full implementation of this test (the test not nearly as available as

the government test), that \$200 million a year in accident damage could be saved. U.S. safety officials feel that a private, nonprofit organization such as IAM offers the most hope in affecting the licensing picture in America and that reduced insurance rates, as associated with IAM membership, is the best way to interest the general public in safer driving.

by Steve Thompson  
 Publ: Motor Trend v31 n6 p68, 70-2, 75 (Jun 1979)  
 1979  
 Availability: See publication

## HS-026 320

### **ANALYSIS OF PEDESTRIAN CROSSWALK SAFETY ON ONE-WAY STREET NETWORKS. FINAL REPORT**

An exploration was made of causal factors that explain why left-turn-vehicle pedestrian accidents are twice as frequent as right-turn accidents on one-way street networks; the New York City Police Dept. accident file was used in the analysis. Driver visual field and attention are indicated to be primary contributory factors in left-turning accidents. Lighting and signal placement are also factors that explain some of the differences between left- and right-turning pedestrian accidents. Recommended countermeasures include extensive driver education to improve awareness of hazardous left-turning maneuvers, redesign of vehicle to improve sight angles (optimum design being equal left- and right-turning sight angles, elimination of vent-window design and increased windshield wiper area); placement of additional traffic signal above the turning crosswalk at the far side of the intersection in order to improve driver's target detection and to increase eye contact; and environmental changes (improved lighting, a clear sidewalk 50 ft upstream of intersection, a 12 ft to 15 ft parking lane, and a 3 ft indentation (into the block) of the turning crosswalk).

by P.A. Habib; R.P. Edelstein; O.I. Nwankwor  
 Polytechnic Inst. of New York, Dept. of Transportation  
 Planning and Engineering, 333 Jay St., Brooklyn, N.Y. 11201  
 DOT-OS-70057  
 Rept. No. DOT/RSPA/DPB-50/78/28; PB-291 328 ; 1978 ; 76p  
 10refs  
 Availability: NTIS

## HS-026 321

### **A LIMITED EVALUATION OF REFLECTIVE AND NON-REFLECTIVE BACKGROUND FOR OVERHEAD SIGNS. FINAL REPORT**

A study was undertaken to evaluate the feasibility of using reflective sign sheeting, either engineering grade (Class I) or high-intensity grade (Class II), as background material for selected overhead highway signs, or using presently accepted nonreflective, opaque, porcelain enamel backgrounds but without external illumination. Two sets of overhead signs were placed at two sites, at the junction of I-81 I-78 east of Harrisburg, Pa., where motorist interviews and photometric readings were recorded. The results indicate that the motorists generally preferred the unlighted high-intensity signs as compared to unlighted nonreflective or engineering grade signs. Photometric readings indicated greatest contrast ratio with reflective button copy on the nonreflective background when not illuminated. It is concluded that signs with the reflective backgrounds and legends used in this study could fully provide an acceptable level of service when not self-illuminated on freeway-type highways with tangent section a minimum of 1200 ft in length.

Illuminated, nonreflective signs with button copy yield high contrast ratios and provide a level of service equal to the alternate sign types tested. The individual states should have the prerogative of deciding which background type; legend, and illumination condition provide the best service in their areas of jurisdiction.

by Norman Bryan, Jr.; Donald Casner; Robert Klotz; Harold Knisley  
 Pennsylvania Dept. of Transportation, Bureau of Materials, Testing and Res., 1118 State St., Harrisburg, Pa. 17120  
 Rept. No. FHWA-PA-78-19; PB-291 577 ; 1978 ; 46p 8refs  
 Sponsored by Federal Hwy. Administration  
 Availability: NTIS  
 1978 ; 62p refs  
 Availability: Corporate author

## HS-026 323

### **AN ALTERNATIVE TO THE CRIMINALITY OF DRIVING WHILE INTOXICATED**

The following negative aspects of conventional DWI (driving while intoxicated) enforcement programs are outlined: failure to change the behavioral attitude of the offender, lack of wholehearted support of the police, tendency to be unjust, corrupt, and self-defeating, and placement of defense counsel in a nonproductive and unsatisfying role. The following criteria are outlined for a successful DWI enforcement program: a substantial increase in arrests of offenders; a rapid, low-cost flow of apprehended drivers through the courts; a concerted, meaningful effort from many sources towards changing the behavior of the arrested offender; a finality to litigation and a probationary period to determine the effectiveness of the treatment program; an ongoing evaluation of the overall effectiveness of the program; and a balance of involved economic interests. In the three-year Park Forrest, Illinois, Lutheran General Hosp. Program for DWI offenders, a two-page information sheet is given to the offender, emphasizing the seriousness of the offense and defining possible sanctions if the offender proceeds to trial and pleads guilty or is found guilty. An alternative is offered to the offender to participate in a voluntary alcohol diagnostic evaluation test and recommended treatment program tailored to offender needs. The hospital evaluation program provides a psychosocial evaluation of drinking/drug impact on a person's functioning. Upon completion of testing procedures, the therapist outlines for the prosecutor his findings and recommendations. Copies of the report are given to the defendant, defense counsel, and arresting officer. In a petition, the parties ask the court to accept a guilty plea, record a finding thereof, set a temporary \$100 fine and \$5 costs, and honor a joint motion to vacate that finding and penalty after a one-year probationary period. The fine and costs are paid only if the motion to vacate is denied. The arrest rate has been around 200 to 350 DW cases annually for the Park Forest community of 34,000 with a recidivism rate around 3%. There have been no jury trials and only a few contested cases.

by Richard W. Hall  
 Publ: Journal of Public Science and Administration v5 n2 p138-44 (Jun 1977)  
 1977  
 Availability: See publication

HS-026 324

**HELMET LAWS DWINDLE: DEATH TOLL MOUNT  
[MOTORCYCLING]**

Various statistics and opinions are cited concerning helmet usage by motorcyclists, with emphasis on mandatory helmet use laws. Information is provided on motorcycle helmet safety, standards, construction, and proper use. Although a 1974 National Hwy. Traffic Safety Administration (NHTSA) study found that nonhelmeted cyclists suffer three times as many fatal or serious head injuries as helmeted cyclists motorcyclists have apparently convinced Congress and most state legislators that government should not mandate helmet usage. A 1967 NHTSA rule withheld Federal highway funds from states not requiring helmet usage; by 1975, 47 states, the District of Columbia, and Puerto Rico had mandatory helmet laws. A 1976 law prevented NHTSA from enforcing helmet laws by withholding funds. At present, 29 states do not require motorcyclists 18 years or older to wear helmets. Motorcycle fatalities rose 24% in 1977 over 1976, although registration rose only 1%. The motorcycle industry and motorcyclist groups have lobbied strongly on the Federal and state levels against mandatory helmet usage, with the right of personal choice proving to be the strongest argument. On the other hand, insurance companies, medical experts, and a Federal judge contend that society pays the bill when a helmetless cyclist is severely or fatally injured. Many physicians support helmet use legislation not only on the basis of medical research findings but also because of personal experience in emergency rooms. An American Medical Assoc. report compiling research by experts on both sides of the issue counters charges that helmets contribute to neck and spine injuries and cause accidents. Although the general consensus is that helmets increase the chances of surviving a motorcycle accident, motorcyclists are not pleased with the government's approach to motorcycle safety. Meanwhile, Federal and state regulators predict that helmet use laws may return when motorcycle fatality figures are made available.

Publ: Journal of America Insurance v54 n2 p24-9 (Summer 1978)

1978 ; 3refs

Availability: See publication

HS-026 325

**BRAKING AND LOCKING CHARACTERISTICS OF  
VARIOUS TYPES OF MOTORCYCLE BRAKE  
SYSTEMS (BREMS- UND BLOCKIERVERHALTEN  
VON MOTORRADERN MIT VERSCHIEDENEN  
BREMSSYSTEMEN)**

The braking and wheel-locking characteristics are examined of the conventional motorcycle brake system (separate actuation of the front and rear brakes) and the possibilities and problems associated with a new system being developed (simultaneous actuation of the front and rear brakes). Although the conventional system allows the experienced driver to achieve an optimal deceleration, the inexperienced motorcycle driver, accustomed to driving cars, fails to achieve the proper decelerations for a given road traction conditions. By locking a rear or front wheel too early, the novice motorcyclist initiates a fall which could have been avoided. The "combined" brake system with coupled rear and front brake actuation could help to prevent this type of fall. A detailed analysis indicates that it is difficult to design brake systems and pressure equalizers which would be satisfactory under all load and road conditions and which would always compensate for lack of rider skill.

by Henning Lupertz

Publ: ATZ Automobiltechnische Zeitschrift v81 n3 p99-102, 107 (1979)

1979 ; 18p 1ref

Translated from German (original 5p; translation 13p).

Availability: Reference copy only

1978 ; 14refs

Availability: See publication

HS-026 327

**SELECTING THE OPTIMUM ENGINE  
CONNECTING ROD MANUFACTURING PROCESS**

Automotive engine connecting rods are used as an example in applying an optimum manufacturing process selection algorithm. The technique used to compare manufacturing processes, a modification of Kepner-Tregoe Problem Analysis, involves the itemization of basic goals into small entities, settings of priorities on these goals, and summing the effect of how well each process option satisfies each specific goal. Prior to defining the goals or "wants", mandatory processing requirements or "musts" are determined. These "musts" (e.g. use available material, yield an acceptable part) are essential elements which serve as go/no go decision criteria. Five processing scenarios (forging by gas slot heat and hammer forge, or by induction heat and press forge, nodular iron casting, hot formed powder metal, and precision warm forming) are compared in terms of the following goals: use of available material, minimization of energy use, reduction of vehicle weight, minimization of piece cost, high quality, minimization of investment, use of existing technology, viable steps to production, and positive safety, environmental, and personnel effects. Casting is determined to be the optimum connecting rod manufacturing process, based on the assumptions that a new product is involved and that a building is available without equipment or personnel.

by Dale A. Maynard

Chrysler Corp.

Rept. No. SAE-790023 ; 1979 ; 11p 1ref

Technical Paper Series. Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.

Availability: SAE

HS-026 328

**HIGHWAY ACCIDENT REPORT. OVERTURN OF A  
YPSILANTI, MICHIGAN, BOYS CLUB BUS, I-75,  
NEAR TIFTON, GEORGIA, APRIL 11, 1978**

A "school bus"-type bus operated by the Ypsilanti (michigan) Boys Club, occupied by 56 boys and 2 adults, was southbound on I-75 near Tifton, Georgia, en route to Disney World, Florida. As the bus exited I-75 at a safety rest area, it went off the road while negotiating a right curve on the exit lane, overturned, and struck a tree. Three passengers were killed, and the driver and 25 passengers were injured. The probable cause of the accident was the driver's loss of directional control of the bus on the curve because of excessive speed due to the failure of the accelerator return spring, which resulted from improper maintenance. Contributing to the accident were severely under-inflated tires, deteriorated suspension, excessive luggage on the roof, and driver fatigue. Since the accident bus did not transport pupils to school, it did not satisfy the requirements of the Michigan School Code of 1976 and did not have to be inspected. Although the weakened, fatigued accelerator return spring would probably not have been discovered through a periodic state-required vehicle inspection, a properly designed vehicle maintenance program should have identified the defect, resulting in its replacement.

National Transportation Safety Board, Bureau of Accident Investigation, Washington, D.C. 20594  
Rept. No. NTSB-HAR-79-2 ; 1979 ; 29p 2refs  
Availability: NTIS

HS-026 329

# **HIGHWAY ACCIDENT REPORT. OSTERKAMP TRUCKING, INC., TRUCK/FULL TRAILER AND DODGE VAN COLLISION, U.S. 91, NEAR SCIPIO, UTAH, AUGUST 26, 1977**

A 1973 Dodge Van and a 1977 Peterbilt truck, pulling an empty 1977 Reliance full trailer, collided head-on during a moderate-to-heavy rainstorm on U.S. 91, 8 mi north of Scipio, Utah. The eight occupants of the van were killed, and the truck driver was injured. The truck driver said that when the vehicles were quite close and he believed the van driver was not returning to his side of the road, he thought that he must reduce speed to give the van driver time to straighten out. He said that after rapidly and firmly applying the brakes on both truck and trailer, the combination began to skid. As he was attempting to steer out of the skid, he said that he attempted to engage the "jake brake", a device which increases the engine's braking capability but is intended for energy absorption during downhill operations. The physical evidence indicated that both vehicles were straddling the centerline at impact; the truck/full trailer was almost fully on the van's side of the road, while the van was just across the centerline. This evidence did not provide enough information to determine the movements of either vehicle before impact. Limits in this evidence and research data prevented confirmation or denial that the truck driver's alleged evasive actions were necessary, that they took place, or that they would have produced his described loss of control. During the evaluation, a significant lack of research data on the performance of lightly loaded truck tires, and the potential effect of varying pavement frictional quality was noted. The southbound pavement surface approaching the accident site was found to have a progressively lower and widely fluctuating wet frictional quality and an average wet frictional quality below recommended values. Standard pavement inventory test procedures would not have detected these pavement problems at the accident site. The probable cause of this accident was either or both drivers failed to maintain their vehicle in the proper traffic lane for undetermined reasons.

National Transportation Safety Board, Bureau of Accident Investigation, Washington, D.C. 20594  
Rept. No. NTSB-HAR-79-1 ; 1979 ; 29p 8refs  
Availability: NTIS

HS-026 330

# **DIESELS AND FOUR-WHEEL DRIVE**

Among the most technically interesting exhibits at the 1979 Geneva Motor Show were several new diesel engines and four-wheel-drive vehicles. Peugeot has produced a turbocharged version of its 2.3 L diesel for the 603, with increased maximum output (51 KW to 59 KW), increased maximum power (4150 rpm vs. 4500 rpm), and maximum torque of 184 Nm at 2000 rpm (an increase of 40%). Peugeot's diesel for the 305 is a new unit based on the 1.45 L gasoline unit fitted to that car; maximum power and torque, respectively, are 36 KW at 5000 rpm and 87Nm at 2500 rpm. Two other new diesels from VW include the five-cylinder unit, now available in the Audi 100, and the six-cylinder unit in the Volvo 244 GL; specific outputs, respectively, are 51 KW and 60 KW at 4800 rpm, with maximum torques of 123 Nm at 3000 rpm and 140 Nm at 2800 rpm. Detail changes have been made to the diesels in the Mercedes-

Benz 200D and 240D models, with outputs for the former increased from 40 KW to 44 KW, and for the latter from 44 KW to 53 KW. Volvo has enlarged its 2.1 L gasoline engine to 2.3 L for the 242 GT model, with a maximum power output of 103 KW at 5750 rpm, and maximum torque of 191 Nm at 4000 rpm. Saab's experimental car is intended to show the potential for turbocharging; the car develops 128 KW at 5500 rpm and 295 Nm at 3500 rpm. GM's new 1.3 L engine features a crossflow aluminum cylinder head; this engine has an output of 44 KW at 5800 rpm and maximum torque of 97 Nm at 3000 rpm. The Land-Rover V8 engine has been revised to give more low-speed pulling power (maximum output limited to 68 KW at 3500 rpm, although maximum engine speed is 5000 rpm), has a maximum torque of 225 Nm at 2000 rpm. Two new versions of the Chrysler Sunbeam are the Sunbeam Lotus, which is powered by a 2.2 L version of the Lotus 16-valve engine, the Ti, powered by a version of the Chrysler 1.6 L unit. The most significant of the four-wheel-drive vehicles are the Mercedes-Benz G Range and the VW Iltis.

by John Hartley

Publ: Automotive Engineer v4 n2 p14-7 (Apr-May 1979)  
1979

Availability: See publication

HS-026 331

# **THE POTENTIAL FOR ACTIVE SUSPENSION SYSTEMS**

The two fundamental deficiencies in the conventional approaches to suspension system design are the limiting performance characteristics of traditional passive element suspensions and the limiting mathematical procedures used in the design of both passive and active suspensions. Since active suspensions offer considerable potential for overcoming the limitations of passive suspensions, the most appropriate method for designing them must be determined. The synthetic approach to the design of active suspensions has distinct advantages over the analytical procedures of conventional design methods, which involve analyzing the behavior of predefined suspension configuration process which requires considerable time and effort. The synthetic approach enables the desired dynamic characteristics to be assigned before the suspension is constructed and determined the most suitable suspension configuration. The synthesis of suspensions using modern control theories (optimal control theory, modal control theory) is a powerful design technique for both active and passive suspensions.

by H. B. Sutton

Publ: Automotive Engineer v4 n2 p21-4 (Apr-May 1979)  
1979 ; 44refs

Availability: See publication

HS-026 332

# **EMERGENCY VEHICLE OPERATIONS COURSE**

An Emergency Vehicle Operations Course (EVOC) was conducted throughout North Carolina by the Center for Safety Driver Education at Appalachian State Univ., Boone, NC. The Safety Center at East Carolina Univ. The classroom session included two films: one called "Code Three," depicting a police officer on an emergency run to an accident scene, the other entitled "Six Deadly Skids," dealing with six different types of skids and the effect of each on the driver and vehicle. A presentation was used to describe each of the in-car acts and to aid in the discussion of physical and man-made factors. Students received a notebook (with various pamphlets in it).

ed). The main driving exercises, developed by Vehicle Dynamics Lab., involved skid control (braking, cornering, and power skids), serpentine course, evasive maneuvers, controlled braking, off-road recovery, and double-lane change. Each exercise was first presented in regular passenger sedans, then in both a van and a modular ambulance.

by Chris A. Gentile; Charles E. McDaniel  
 Publ: Emergency Medical Services v7 n4 p8, 10, 12, 56 (Jul-Aug 1978)  
 1978  
 Sponsored by North Carolina Office of Emergency medical services.  
 Availability: See publication

HS-026 333

# **FLUID CONDUCTORS AND CONNECTORS. STANDARDS, RECOMMENDED PRACTICES, INFORMATION REPORT. HANDBOOK SUPPLEMENT. 1979 ED.**

Society of Automotive Engineers (SAE) Standards, Recommended Practices, and Information Report for surface vehicle tubing and fittings cover the following areas: coding system for identification of tube, pipe, and hose fittings; automotive tube fittings; spherical and flanged sleeve (compression) tube fittings; refrigeration tube fittings; hydraulic tube and hose fittings and hoses; tests and procedures for SAE 100R Series hydraulic hose and hose assemblies, and for high-temperature transmission oil hose, lubricating oil hose, and hose assemblies; hydraulic flanged tube; pipe, and hose connections, 4-bolt split flange type; hydraulic "O" ring; formed tube ends for hose connections; flares for tubing; low-carbon steel tubing annealed for bending and flaring (seamless, and welded and cold-drawn); low-carbon steel tubing (welded, and brazed, double-wall); welded, flash-controlled, low-carbon steel tubing normalized for bending, double flaring, and beading; pressure ratings for hydraulic tubing and fittings; seamless copper tube; metallic air brake system tubing and pipe; nonmetallic air brake system tubing; performance requirements for SAE J844d nonmetallic tubing and fitting assemblies used in automotive air brake systems; fuel injection tubing; automotive pipe fittings; automotive pipe, filler, and drain plugs; automotive straight thread filler and drain plugs; and lubrication fittings. New, technically revised, or editorially changed entries are indicated; a numerical index is provided.

Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pa. 15096  
 Rept. No. SAE-HS-150; 1979; 146p  
 Availability: SAE

HS-026 334

# **IRON AND STEEL. STANDARDS, RECOMMENDED PRACTICES, INFORMATION REPORTS. HANDBOOK SUPPLEMENT. 1979 ED.**

Society of Automotive Engineers (SAE) Standards, Recommended Practices, and Information Reports for iron steel as related to surface vehicles are provided under the following headings: rules, nomenclature, UNS; numbering system, and chemical compositions of ferrous metals; general data on steels; methods of testing steels; steel fasteners; spring wire and springs; ferrous castings; tool and die steels; ferrous materials; and ferrous and nonferrous-general. New, technically revised, or editorially changed entries are indicated; a numerical index is provided.

Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pa. 15096  
 Rept. No. SAE-HS-30; 1979; 253p refs  
 Availability: SAE

HS-026 335

# **INSTITUTE URGES ACTION FOR CHILD PROTECTION [INSURANCE INSTITUTE FOR HIGHWAY SAFETY, CHILD, RESTRAINTS]**

Dr. William Haddon, Jr., of the Insurance Inst. for Hwy. Safety (IIHS), spoke before the House Commerce Subcommittee on Oversight and Investigation, on child protection in passenger cars and vans. His address is summarized, with still photographs from the film sequences presented at the hearing. Filmed (slow motion) results of new IIHS crash tests using tests dummies and popular 1979 model vehicles showed the following situations: an unbelted mother crushing her lap-held baby violently into the car's instrument panel and windshield in a frontal crash of less than 25 mph; unrestrained children ejected from the open rear window of a station wagon in a 30 mph collision; two youngsters, unrestrained, being violently thrown about in a van crash of less than 25 mph; and an unrestrained infant, lying on the front seat, hurled forward in a 25 mph crash to collide with the long-known child impact area of the instrument panel. Other sequences of the film, showed how well even small children were protected in crashes when wearing adult safety belts. To reduce the toll of nearly 2000 children killed and thousands seriously injured annually in auto crashes, Haddon stated that action must be taken by state and local governments who can mandate child protection laws, the National Hwy. Traffic Safety Administration (NHTSA) which should amend its present Federal Motor Vehicle Safety Standards (FMVSS) in order to eliminate hostile vehicle interior structures, auto manufacturers who can properly design and build cars for occupant protection, and parents and other adults who can place children in restraints. NHTSA administrator Joan Claybrook told of agency efforts to require dynamic testing for child restraints and a current series of child restraint workshops, and Robert E. Vanderbeek, of the League Insurance Companies of Southfield, Mich., described his company's upcoming program for supplying child restraints free of charge to policyholders. In separate sections, it is noted that Joan Claybrook will push for revision of FMVSS 201, Occupant Crash Protection From Interior Impact, and Dr. Haddon calls for proper packaging of human cargo.

Publ: Status Report v14 n8 p2-7 (17 May 1979)  
 1979  
 Availability: See publication

HS-026 336

# **VACATION PLANNER [CAR PREPARATION, TRAVEL PLANNING, AND DRIVING TIPS]**

Information is presented for the vacationing motorist on preparing his car for its journey, planning the trip, saving gas, keeping the children occupied, and staying awake. Vehicle preparation tips include inspection of the tires, belts hoses, oil, filters, steering system, transmission, suspension, exhaust system, electrical system, and brakes. Items to carry for on-the-repairs include spare tire and jack, assortment of tools, oil, some replacement parts, jumper cables, flashlight, flares, and first-aid kit. Travel planning suggestions include knowing exactly where you want to go, how far you can go on a tankful, where you want to be each night, mapping out the route getting the assistance of a



local auto club, and calling ahead for reservations. Essential items not to be forgotten include driver's license, registration, proof of insurance, leave papers, checks and credit cards. To save gas, comfort, and for passenger comfort the car should not be overloaded. Travellers should be stingy about space, take along only minimal clothing, and distribute passengers (each to have a safety belt) and luggage evenly. Advice for entertaining the kids includes giving them coloring books and reading materials, assigning them tasks that require road watching, playing quiz games and singing, and stopping about every two hours for a break. Gas-saving tips include driving slower, at a constant speed (e.g. 50 mph), not accelerating or decelerating rapidly, minimizing use of air conditioning, avoiding unnecessary stops, having the car properly tuned, and having the tires properly inflated. Suggestions for staying alert include finding things to break the monotony, such as switching drivers, talking, playing word games and listening to the radio, and stopping for a break every few hours.

Publ: Driver v12 n12 p0-1, 3-12 (May 1979)  
1979 ; 2refs  
Availability: See publication

## HS-026 337

### TESTING DOUBLES TRAILERS AT THE THRESHOLD OF ROLLOVER [TRACTORS PULLING TWO TRAILERS]

Tests of maneuverability at the rollover limit were made at the Univ. of Michigan's Hwy. Safety Res. Inst. on a full scale tractor/double trailer loaded to simulate a full gasoline load and equipped with outriggers to prevent overturn. The power unit was a short-wheelbase, 3-axle GMC cab-over-engine highway tractor; the lead semitrailer was a 9300-gal capacity Fruehauf tri-axle, 12' 8" high, with three internal compartments; the following trailer was a Fruehauf 7700-gal capacity tri-axle, 13' 3" high, utilizing a tandem-axle converter dolly. Overall combination length was 55 ft, and gross vehicle weight was 152,000 lb. In a simulated lane change as an emergency maneuver, it was found that the steering maneuver amplified at the converter dolly, and that the oscillation continued after the tractor had straightened out. Tests of a dolly hitch modification (a 4-point hitch making the dolly rigid in yaw and roll, but allowing vertical and pitch movements) proved that this modification upgrades the full trailer roll stability to that exhibited by the lead trailer hitched to the tractor. The modified double has slightly less maneuverability than when using the 3-point, pintle-hook hitch, but is still more maneuverable than the long-wheelbase, single-trailer rigs. The tests also proved that the unmodified "A" train is unstable in yaw oscillation if only the rear compartment is loaded and speeds exceed 50 mph. In other testing, a total of 22 retaining bolts were added to the spring suspensions to reduce the lash space to 1/4" to 3/4". This minor modification resulted in a 15% improvement in roll stability. A third modification, lengthening of the wheelbase, offered little benefit to stability. It was concluded that, when modified with a 4-point hitch, the Michigan double-bottom tanker train may have better safety and fire hazard exposure than either the long semitrailer or the short Michigan single that was legislated.

Publ: Trailers/Body Builders v20 n3 p52-4 (Jan 1979)  
1979

Based on SAE-781066 "Testing the Michigan Double-Bottom Tanker," by C.B. Winkler, R. L. Nisonger, and R. D. Ervin, presented at Annual Truck Meeting, Dearborn, Mich., 14 Dec 1978. See also HS-026 338.

Availability: See publicat

## HS-026 338

### NEW HITCH HARDWARE LEGISLATED TO REDUCE DOUBLES ROLL, JACKKNIFE [TRANSPORT OF FLAMMABLE LIQUIDS IN DOUBLE TANK TRAILERS]

two stabilizing devices have so far been certified by the Michigan State Police for the following trailer in a double trailer transporting flammable liquids. Certification requires that a device provide antiroll support from the lead trailer, and prevent the full trailer from pivoting freely about the kingpin of the converter dolly (i.e. prevent jackknife). One device in the Fruehauf 4-point hitch, a very short link pinned to the rear of the lead trailer and to the front of the converter dolly of the following trailer. It locks out yaw and roll completely, allowing only vertical and pitch movements. With this device, the converter dolly no longer steers separately, but is positioned directly behind the wheels of the lead trailer. The other device is the Telescopic Steering Stabilizer patented by Truck Safety Systems, Inc. (Tecumseh, Mich.). This device is added above the regular tongue and hitch of the converter dolly; it locks out the roll of the following trailer and limits the trailer swing. It is connected directly to the rear of the lead trailer frame and the front of the following trailer frame. By 1981, gasoline will not be permitted in double-bottom trailers in Michigan; only the lead trailer will be allowed to haul gasoline. Since No. 1 and No. 2 fuel oils have a flash point above 70 degree (unlike gasoline) they may be transported in double-bottom trailers now and beyond 1981, if the train is equipped with a certified stabilizing device. Three papers concerning double trailer stability are cited: SAE-781064, SAE-781065, and SAE-781066.

Publ: Trailer/Body Builders v20 n3 p56-7 (Jan 1979)  
1979 ; 3refs  
See also HS-026 337.  
Availability: See publication

## HS-026 339

### LIGHTING EQUIPMENT AND PHOTOMETRIC TESTS, STANDARDS, RECOMMENDED PRACTICES, INFORMATION REPORTS. HANDBOOK SUPPLEMENT. 1979 ED.

Society of Automotive Engineers Standards, Recommended Practices, and Information Reports on surface vehicle lighting equipment and photometric tests cover circuit breakers; ignition switches; windshield washers/wipers; blower motor switches; cigar lighter receptacles; lighting terminology and identification codes; headlamps; lamp bulb retention systems; connectors and plugs; sealed beam headlamps; general service sealed lighting units; lamp bulbs; lenses and reflectors; signal lights; fog lamps; auxiliary low-beam lamps; motorcycle headlamps, turn signals, and electrical systems; tail lamps; stop lamps; license plate lamps; supplemental high-mounted stop and rear turn signal; side turn signals; cornering lamps; warning flashers; spot lamps; parking lamps; clearance, side marker, and identification lamps; backup lamps; reflex reflectors; emergency warning devices; service, maintenance, and emergency vehicles' flashing warning lamps; lighting inspection codes; headlamp testing machines; headlamp aiming devices; incandescent lamp impact tests; and flasher test equipment. New, technically revised, or editorially changed entries are indicated. A numerical index is provided.

Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pa. 15096  
Rept. No. SAE-HS-34 ; 1979 ; 84p refs  
Availability: SAE



HS-026 340

# **CLASSIFICATION OF MEN ARRESTED FOR DRIVING WHILE INTOXICATED, AND TREATMENT IMPLICATIONS. A CLUSTER-ANALYTIC STUDY**

The study attempts to identify by cluster analysis the patterns of alcohol impairment and neuroticism in a sample of men arrested for driving while intoxicated (DWI) in Philadelphia, and to differentiate types of offenders according to psychosocial characteristics and drinking histories, suggesting how distinct types of DWI offenders might be treated in the present judicial, educational and clinical framework. Statistical analysis of blood alcohol concentration at time of arrest, quantity-frequency level of drinking and scores on an impairment index and the N Scale of the Eysenck Personality Inventory differentiated seven types among 1500 men arrested for driving while intoxicated. Treatment regimens for the seven groups are suggested.

by Robert A. Steer; Eric W. Fine; Pascal E. Scoles  
 Publ: Journal of Studies on Alcohol v40 n3 p222-9 (Mar 1979)  
 1979 ; 11refs  
 Availability: See publication

HS-026 341

# **TRAFFIC FLOW EVALUATION OF PAVEMENT INSET LIGHTS FOR USE DURING FOG. FINAL REPORT**

A lighting system consisting of pavement inset lights to aid motorists during periods of fog was installed on a 5.8-mile (9.4-km) section of I-64, traversing the top of Afton Mountain. Data were collected before and after the lights were installed. Traffic flow parameters were vehicle speeds headways, queues, and lateral placement, and a before and after accident analysis was made. Overall the lighting system led to higher nighttime speeds, an increase in speed differentials for various cases during both day and night, and a decrease in nighttime headways and queuing. Although such changes in traffic flow characteristics might lead to an increase in the potential for accidents, they are considered to be a result of the inset lighting system providing improved delineation for the guidance of motorists, and a system of matrix type fog warning and advisory speed signs is proposed for regulating speeds within the system of guidance lights.

by Frank D. Shepard  
 Virginia Hwy. and Transportation Res. Council, Charlottesville, Va.  
 Rept. No. VHTRC-78-\*R25 ; 1977 ; 29p 2refs  
 Prepared in cooperation with Federal Hwy. Administration.  
 Availability: Corporate author

HS-026 342

# **AUTOMOBILE FUEL ECONOMY STANDARDS FOR 1981-1985. A REVIEW AND RECOMMENDATIONS**

The Dept. of Commerce (DOC), after analyzing the fuel economy standards proposed by the Dept. of Transportation (DOT), concludes that the goal of 27.5 mpg by 1935 is feasible, but prefers an alternative method of implementation. DOT proposes "front-loaded" standards: more rapid increases in mpg required during the early years of the program than in later years; the DOC recommends a straight-line approach requiring equal annual mpg improvements. Reasons for this preference include cost effectiveness of the straight-line approach as opposed to the

cost of the front-load standard, an adequate margin for error in view of the technological and economic uncertainties involved; the increased regulatory burden faced by the auto industry through the mid-1980's in complying with more stringent emission and safety regulations and fuel economy standards, for which the straight-line approach would provided more flexibility. Savings to the auto buying public by switching from the front-loaded to a straight-line standard are estimated to be approximately \$2 billion, in 1978 dollars.

Department of Commerce  
 1979 ; 29p  
 Availability: Corporate author

HS-026 343

# **MOTORISTS' REQUIREMENTS FOR ACTIVE GRADE CROSSING WARNING DEVICES. FINAL REPORT**

A two-year study examined some of the basic problems involved in improving the design of active warning devices intended to make motorists more aware of grade crossing hazards. Emphasis was placed on the improvement of the attention-getting aspect (conspicuity) of active crossing warning devices which was presumed to correlate positively with improvements in grade crossing safety. Following a literature survey, an indoor laboratory test was conducted in the Federal Aviation Administration Low Visibility Res. Facility. More than 150 subjects gave over 20,000 responses to flashing light displays. Results were analyzed to determine effects of color, flash rate, brightness, size, and placement under daylight, darkness, and daytime fog conditions. The laboratory tests resulted in development of two improved devices which were field tests on actual grade crossings. The first device consisted of an array of three eight-inch, white (clear) strobe lights added to a standard flashing warning system at a high accident rate urban crossing in Richmond, Calif. The second device was added to a gate arm and consisted of three small strobes, colored red, white (clear), and blue, installed at a rural highway grade crossing with high-speed truck and automobile traffic. Due to project restraints, no long-term safety improvement analysis could be conducted. Because there was no evidence of driver confusion during the conduct of these field tests, it is concluded that colored lights other than red can be used in moderation as add-on to existing active cross warning devices to increase conspicuity. The high composite (not from a single source) flash-rate devices that were installed did not result in any erratic driving behavior of approaching motorists. (Appended are an annotated bibliography (divided into subject categories) and discussions of visual perception, statistical procedures, and raw data (procedures) results (including tabulated summary).

by R.J. Ruden; C.F. Wasser; S. Hulbert; A. Burg  
 MBAssociates, P.O. Box 196, San Ramon, Calif. 94583  
 DOT-FH-11-8846  
 Rept. No. FHWA-RD-77-167; MB-\*R-77/72 ; 1977 ; 274p refs  
 Rept. for Jul 1975-Aug 1977.  
 Availability: NTIS

HS-026 344

# **THE EFFECTS OF RADIO AND PRESS PUBLICITY ON THE SAFE CARRIAGE OF CHILDREN IN CARS**

In Apr 1978, Australia's Office of Road Safety conducted a national press and radio publicity campaign aimed at increasing the fitting and use by children of conventional seat belts where child restraints were not available, and relocating children, par-

ticularly those unrestrained, from front to rear seats. Undertaken in states with and without child restraint legislation, the effect of the campaign was evaluated using data from roadside observations of restraint fitting and use. Although the campaign was not effective in achieving the desired changes, it did provide valuable data on the transport of children in cars. It was found that over one-third of children have no form of restraint available in the seating position they occupy; only one-fifth to one-quarter of children have a child restraint available, and about one-quarter of these are unapproved. The usage rate is between one-quarter and one-third of all children; about half of the children with an available restraint use it; where child restraints are fitted, usage rate is high (about 90%). The majority of children ride in the rear seat, with 10% to 15% riding in the front seat in Victoria, where unrestrained children are prohibited in the front seat, and around 25% to 30% in South Australia and Western Australia where there is no such prohibition. A copy of the safety campaign press advertisement is appended.

by C.J. Boughton; I.R. Johnston  
Department of Transport, Office of Road Safety, Australia  
Rept. No. SAE-790075 ; 1979 ; 19p 8refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 345

## **TRANSPORTATION FOR THE ELDERLY AND HANDICAPPED: PROGRAMS AND PROBLEMS**

A distillation of papers on transportation for the elderly and handicapped includes presentations from a national perspective, a brief history of the major Federal legislation affecting transportation programs for elderly and handicapped persons, one disabled individual's opinion on barrier-free transportation, discussions of planning and implementation methods, examples of state (California, Oregon, Pennsylvania, Georgia, Tennessee), rural (Iowa, South Carolina), and urban (Louisville, Atlanta, Montgomery, Dade County (Fla.), Evanston (Ill.), San Antonio, Spokane) programs, and discussion of driver training and equipment selection. The authors include staff representatives from both the House and Senate Committees on Aging; other Federal officials; advocates from the transit industry, the user groups, and the nonprofit social agencies; planners and consultants who have developed model methodologies; state and local program managers; and legal experts. A glossary is provided, defining possibly unfamiliar terms and abbreviations used by the authors, as well as a list of the authors and their addresses and phone numbers. This report is a companion to an annotated bibliography, "Transportation and the Elderly and Handicapped: A Literature Capsule" (Jan 1977).

Transportation Systems Center, Technology Sharing Prog.  
Office, Kendall Square, Cambridge, Mass. 02142  
1978 ; 154p refs  
Dept. of Transportation technology Sharing Prog. Abridged  
versions of papers presented at 6th Annual Conference on  
Transportation for the Elderly and Handicapped, Tallahassee,  
Fla., Dec 1977, sponsored by Florida State Univ.  
Availability: Corporate author

HS-026 346

## **SIMPLIFIED AIDS FOR TRANSPORTATION ANALYSIS. ANNOTATED BIBLIOGRAPHY OF ANALYTICAL AIDS. FINAL REPORT**

In Jan 1976, the Dept. of Transportation issued Technical Notice DOT-T-1-76 requesting transportation planners, engi-

neers, and transit operators to submit useful but not widely known manual techniques that could be developed and distributed as simplified aids for transportation analysis. An annotated summary is presented of each of the more than 70 analytical aids that were submitted. For each case, a brief description of the aid is provided, the submitting person or agency is identified, and, in many cases, a reference document is suggested which describes the technique and/or its application. The descriptions are intended to assist the transportation analyst in determining which of the aids might be useful in a particular local application. The aids, presented alphabetically by source, are described in the following functional categories: planning, evaluation, and design for conventional bus and transit and paratransit; planning, evaluation, and design for express bus and rail transit; transit route monitoring and evaluation; sketch planning analysis; trip generation analysis; land use planning and activity allocation analysis; economic analysis; parking analysis; environmental analysis; and miscellaneous functions, such as traffic safety, traffic operations, intercity travel, and air travel.

Pest, Marwick, Mitchell and Co., 1025 Connecticut Ave., N.W.,  
Washington, D.C. 20036  
DOT-UT-50021  
Rept. No. UMTA-IT-06-9020-79-1 ; 1979 ; 112p refs  
See also HS-026 347--HS-026 351.  
Availability: NTIS

HS-026 347

## **SUMPLIFIED AIDS FOR TRANSPORTATION ANALYSIS. DERIVATION AND USE OF AUTOMOBILE AVAILABILITY AS A VARIABLE FOR ESTIMATING TRAVEL DEMAND. FINAL REPORT**

As one of a collection of useful but not widely known manual techniques employed by local transportation planners, engineers, or transit operators, a method is described for deriving an important socioeconomic variable in travel demand estimation, namely, automobile availability per household. This variable was found to be a function of two other variables: the average market price of homes, and the percent of home ownership. Local data at the level of detail required for transportation demand analyses (e.g. transportation planning zone, traffic zone, or census block) is generally more readily available for these factors. The analytical aid, required data and information, application procedure, and analysis output are outlined in an introductory section. The results of a research project are presented which determined the functional relation used to estimate automobile availability per household, and a method is provided for developing a similar function using local data. Two examples of travel demand models (trip generation, model split) using the variable are presented. Shortcomings and limitations of the analytical aid are addressed.

Peat, Marwick, Mitchell and Co., 1025 Connecticut Ave., N.W.,  
Washington, D.C. 20036  
DOT-UT-50021  
Rept. No. UMTA-IT-06-9020-79-2 ; 1979 ; 35p 6refs  
Based on original work by Michael Holoszyk and Dale Miller,  
Princeton Univ. See also HS-026 346, and HS-026 348--HS-026  
351.  
Availability: NTIS

HS-026 348

**SIMPLIFIED AIDS FOR TRANSPORTATION ANALYSIS. ESTIMATING ANNUAL RIDERSHIP AND OPERATING EXPENSE FOR FIXED ROUTE BUS SYSTEMS IN SMALL URBAN AREAS. FINAL REPORT**

As one of a collection of useful but not widely known manual techniques employed by local transportation planners, engineers, or transit operators, a simple method is presented for estimating the annual ridership and operating expenses of fixed-route bus system alternatives in urban areas with populations of less than 300,000. The method is based on regression equations generated principally from 1974 operating data for 55 U.S. fixed-route bus systems. These equations can be used to develop preliminary estimates of the annual ridership and public financial operating assistance required for such systems in small, urban areas. The equations can be solved using a hand calculator and readily available data inputs. The analytical aid, required data and information, and analysis output are outlined in an introduction section. The estimation equations are described, and their use illustrated. Shortcomings and limitations of the analytical aid are addressed.

Peat, Marwick, Mitchell and Co., 1025 Connecticut Ave., N.W., Washington, D.C. 20036  
DOT-UT-50021

Rept. No. UMTA-IT-06-9020-79-3 ; 1979 ; 29p 7refs

Based on original work by John Collura, North Carolina Dept. of Transportation. See also HS-026 346, HS-026 347, and HS-026 349--HS-026 351.

Availability: NTIS

HS-026 349

**SIMPLIFIED AIDS FOR TRANSPORTATION ANALYSIS. METHODOLOGY FOR TRANSIT ROUTE EVALUATION. FINAL REPORT**

As one of a collection of useful but not widely known manual techniques employed by local transportation planners, engineers, or transit operators, a method is presented for evaluating individual transit routes for a fixed-route, fixed-schedule urban transit system. Individual transit system routes are evaluated semiannually, based on a comparison of nine performance factors with established route standards set for each factor. These factors are average revenue passengers per month, average monthly passenger growth, percent growth per month, total passengers per trip, average capacity utilization factor, percent transfers, operating revenue per mile, operating revenue per hour, and net operating cost per passenger. Input data used in the evaluation are recorded semiannually and scores computed for each of the performance factors for each route according to an evaluation score algorithm. Scores are then added for each route, and routes ranked by their total evaluation score. Results are used as the basis for route refinement and modification decisions. The procedure is best applied to systems whose overall ridership is growing. The analytical aid, required input data, and application procedure are outlined in an introductory section. Detailed instructions for conducting a transit route evaluation, and an example to illustrate the procedure and its output are provided. Shortcomings and limitations of the analytical aid are addressed, including ways to modify it to suit individual user needs. Appended is a list of the analytical variables, including their definitions, notations, and derivations.

Peat, Marwick, Mitchell and Co., 1025 Connecticut Ave., N.W., Washington, D.C. 20036  
DOT-UT-50021

Rept. No. UMTA-IT-06-9020-79-4 ; 1979 ; 37p 6refs

Based on original work by John Whittington, San Diego Transit Corp. See also HS-026 346--HS-026348, HS-026 350, and HS-026 351.

Availability: NTIS

HS-026 350

**SIMPLIFIED AIDS FOR TRANSPORTATION ANALYSIS. METHODOLOGY FOR ESTIMATING PARKING ACCUMULATION. FINAL REPORT**

As one of a collection of useful but not widely known manual techniques employed by local transportation planners, engineers, or transit operators, a method is presented for estimating the accumulation of parked vehicles within a study area on a typical weekday. Parking accumulation and utilization of parking facilities may be estimated for all parkers, long-term, and/or short-term, based on an estimate of daily automobile trip destinations, an inventory of available parking supply, and a set of parking "accumulation factors" (which may be derived from a parking survey within the study area or from default values which are provided). The primary use of the method is to analyze the adequacy of available parking supply in relation to expected parking demand. The method may also be used to monitor and suggest revisions to automobile travel impedance values used in transportation planning models. The analytical aid, required input data and information, application procedure, and analysis output are outlined in an introductory section. A detailed description of the data and information required and the most likely data sources are provided. The step-by-step procedures for calculating parking accumulation, determining the utilization of existing or planned parking facilities, and estimating the required new or additional parking spaces are described. The analysis procedure is illustrated with a hypothetical case study. Shortcomings and limitations of the analytical aid are addressed. Appended is a description of the derivation of the accumulation factors.

Peat, Marwick, Mitchell and Co., 1025 Connecticut Ave., N.W., Washington, D.C. 20036  
DOT-UT-50021

Rept. No. UMTA-IT-06-9020-79-5 ; 1979 ; 47p 13refs

See also HS-026 346--HS-026 349, and HS-026 351.

Availability: NTIS

HS-026 351

**SIMPLIFIED AIDS FOR TRANSPORTATION ANALYSIS. ESTIMATING FRINGE PARKING SITE REQUIREMENTS. FINAL REPORT**

As one of a collection of useful but not widely known manual techniques employed by local transportation planners, engineers, or transit operators, a method is presented for identifying candidate sites for change-of-mode fringe parking facilities, for estimating specific parking facility requirements at these candidate sites, and highway access requirements. The analytical aid, required data and information, and analysis output are outlined in an introductory section. Criteria for use in identifying candidate change-of-mode sites are suggested, a qualitative analysis method is described, with input data required to perform preliminary screening of the sites and to select those sites which warrant further analysis. A five-step quantitative procedure is described for use in determining parking space requirements for candidate sites; the procedure involves delineating origin and

destination market influence areas for each site and identifying the transportation zones which make up each influence area; estimating total daily person trip interchanges between origin and destination market influence areas; estimating the proportion of each trip interchange that will use the line-haul mode (commuter railroad, rapid transit, or express bus); estimating the proportion of daily line-haul riders that will use the change-of-mode fringe parking facility; and calculating the new or additional parking facilities required at each site. A method for estimating highway access requirements for candidate sites is provided, and a format for preparing an evaluation profile of the sites is presented. Shortcomings and limitations of the analytical aid are addressed.

Peat, Marwick, Mitchell and Co., 1025 Connecticut Ave., N.W., Washington, D.C. 20036  
DOT-UT-50021  
Rept. No. UMTA-IT-06-9020-70-6 ; 1979 ; 64p 17refs  
Based on original work by Charles Dougherty, Lawrence S. Golfin, and Rasin K. Mufti, Delaware Valley Regional Planning Commission. See also HS-026 346--HS-026 350.  
Availability: NTIS

HS-026 352

### **TURBOCHARGERS AND TURBOCHARGED ENGINES**

Following an overview of the automotive turbocharger, 12 papers are compiled on turbochargers and turbocharged engines. Papers on turbocharged engines cover the following topics: turbocharging small-displacement, spark ignition engines for improved fuel economy, installation and design problems associated with the automotive turbocharger turbocharging four-cycle diesel engines, turbocharger compressor performance evaluation and critical flow field measurements, and exhaust emissions from a European light-duty turbocharged diesel. Papers on "turbochargers in the 80's" cover the following topics: current trends and future prospects for turbochargers in the 1980's, variable-area turbocharger for high-output diesel engines; the effect of compressor and turbine specific speed on turbocharger efficiency and engine performance; centrifugal compressor development for a variable-area turbocharger; series turbocharging--a requirement for high specific output vehicular diesel engines; estimating the influence of pulsating flow conditions on the performance of a turbine; and Helmholtz-tuned induction system for turbocharged diesel engine.

Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pa. 15096  
Rept. No. SAE-SP-442 ; 1979 ; 149p refs  
Includes HS-026 353--HS-026 364. Papers presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 353

### **TURBOCHARGING SMALL DISPLACEMENT SPARK IGNITION ENGINES FOR IMPROVED FUEL ECONOMY**

An approach is described for improving fuel economy by using turbocharged, spark ignition engines of relatively small displacement, 1.6 L, 4-cylinder and 2.2 L, 5-cylinder, to replace larger, naturally aspirated engines of the same power potential. A low-flow turbocharger is used to realize a given peak performance with good power characteristics over the entire engine speed range. The boost pressure is controlled by a wastegate. The air-fuel mixture is prepared by a two-stage carburetor at the intake of the turbocharger compressor. The oxygen concentration in

the exhaust gas is measured by an oxygen sensor upstream of a three-way catalyst. A detailed description is given of the turbocharger installation, charge pressure control, and air-fuel mixture control. A system for the stabilization of engine speed at idle with simultaneous increase of exhaust gas temperature is described. The effects of the compression ratio on fuel economy in the Urban Driving Cycle (UDC) are discussed. Preliminary emission and fuel economy test results are presented for the 4-cylinder engine. UDC emissions for the 3000-lb vehicle with 1.6 L engine were 0.19 g/mi HC (hydrocarbon), 3.27 g/mi CO (carbon monoxide), and 0.71 g/mi NOX (nitrogen oxides). Highway Driving Cycle (HDC) emissions were 0.01 g/mi, 0.91 g/mi, and 0.78 g/mi, respectively, for HC, CO, and NOX. Further work is needed in tuning the carburetor feedback system and in exhaust gas aftertreatment to meet emission goals. Fuel economy results were 43 mpg HDC and 26 mpg UDC.

by K.-D. Emmenthal; G. Hagemann; W.-H. Hucho  
Volkswagenwerk A.G., Wolfsburg, Germany  
Publ: HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines," Warrendale, Pa., 1979 P1-8  
Rept. No. SAE-790311 ; 1979 ; 8refs  
Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.  
Availability: In HS-026 352

HS-026 354

### **INSTALLATION AND DESIGN PROBLEMS ASSOCIATED WITH THE AUTOMOTIVE TURBOCHARGER**

The Schwitzer S6 automotive turbocharger was designed with the philosophy of severe economic guidelines and mounting versatility. In order to meet the design goals, a number of unique items had to be considered and incorporated in the turbocharger. The current design can be mounted from within degree of horizontal to within 10 degree of vertical. The bearing housing is sandwiched between the compressor end flange plate and the turbine housing, with retention by three cross bolts located at 120 degree intervals. This arrangement allows the gravity oil drain to be rotated within the intervals between the bolts. The bearing system was simplified by using a free floating, nonrotatable sleeve bearing with axial thrust capability to replace the Schwitzer rotating journal with a separate thrust bearing. The wastegate system is comprised of a rotary valve actuated by a remote boost-controlled, spring-loaded diaphragm. This concept allows the turbine to be bypassed to avoid an increase in engine back pressure as a result of the presence of the turbocharger at high cruising speeds. The rotary valve has the advantage of a positive self-cleaning feature and requires less close tolerance machining than a more conventional poppet valve arrangement. The control mechanism for the wastegate is located remote from the turbine housing, which allows the use of less expensive, less corrosion-resistant parts.

by Kenneth F. Kaiser; Charles R. Sarle; Bruce R. Owen  
Wallace Murray Corp., Schwitzer Div., Indianapolis, Ind.  
Publ: HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines," Warrendale, Pa., 1979 p9-23  
Rept. No. SAE-790313 ; 1979 ; 3refs  
Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.  
Availability: In HS-026 352

HS-026 355

**TURBOCHARGING FOUR-CYCLE DIESEL ENGINES**

The interaction of turbocharger characteristics with engine design and performance parameters is discussed. The matching of a turbocharger to an engine configuration by the choice of turbomachinery components is a very complex mix of performance and mechanical compromises. A variety of factors must be considered, each of which has an impact on all aspects of the overall package performance. Air-fuel ratios must be adjusted in order to optimize the engine combustion system performance. Firing pressures must be controlled to stay within the accepted boundaries for mechanical stresses in the hardware. The firing pressure limit controls the amount of turbine work that can be extracted in a given situation. These combined limits then control the transient response and torque peak-speed output. They also provide a limit to the torque rise attainable. The turbocharged engine characteristics are an interactive combination of the engine combustion system and mechanical design constraints and turbocharger characteristics. A series of tradeoffs must be optimized if the designer is going to achieve an overall acceptable performance for the system. In order to relieve some of the significant constraints on the system, efforts in turbomachinery design must concentrate on developing efficient, broad-range compressors which are driven by efficient, responsive, variable-geometry turbines.

by Patrick F. Flynn

Cummins Engine Co.

Publ: HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines," Warrendale, Pa., 1979 p25-37

Rept. No. SAE-790314 ; 1979 ; 9refs

Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.

Availability: In HS-026 352

HS-026 356

**TURBOCHARGER COMPRESSOR PERFORMANCE EVALUATION AND CRITICAL FLOW FIELD MEASUREMENTS**

A detailed study of two commercial turbocharger compressor impellers (full-blade, and partial-blade or cutback) with a parallel-wall, vaneless diffuser was carried out to expand understanding of current turbocharger test procedures and to lay the groundwork for an "industrially useable" method to assess discharge conditions from radial turbomachinery rotors. The study demonstrated that present turbocharger compressor maps from different sources cannot be reliably compared because random errors can amount to plus/minus 0.05 (5 points) on efficiency (20:1 odds). Common sources of random error include uncalibrated thermocouples, stem errors, improperly formed pressure taps, and transducer and electronic processing errors. For the particular impellers and vaneless diffusers tested, a diffuser flow field was found for which the flow followed the diffuser rear (hub) surface at impeller discharge with backflow at the shroud; the pattern reversed midway through the diffuser with attachment along the front (shroud) and with reverse flow along the back wall (hub). The traverses were invaluable in deducing the flow field structure. Although the quantitative diffuser results were useful in providing upper and lower data bounds on basic parameters heretofore deduced (slip factor, backflow loss, rotor efficiency, diffuser recovery), difficult probe/measurement questions must be resolved before quantitatively precise results will be obtained. The full-blade impeller plus diffuser appeared to be slightly superior to the partial-blade impeller plus diffuser.

by David Japikse; Jay Goebel

Creare Inc., Hanover, N.H.

Publ: HS-026 352 (SAE-SP-442), "Turbochargers and

Turbocharged Engines," Warrendale, Pa., 1979 p39-58

Rept. No. SAE-790315 ; 1979 ; 10refs

Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.

Availability: In HS-026 352

HS-026 357

**EXHAUST EMISSIONS FROM A EUROPEAN LIGHT DUTY TURBOCHARGED DIESEL**

The impact of turbocharging on diesel exhaust emissions was investigated by studying a 4-cylinder, indirect injection (IDI) Fiat engine with different configurations (fuel injection optimization, exhaust gas recirculation (EGR), oxidation catalyst, turbocharging). Experimental results obtained during bench and chassis dynamometer tests were compared with the results from the same tests performed in the naturally aspirated (NA) 4-cylinder engine. Mathematical models were used in order to identify the regions maximally contributing to regulated emissions of HC (hydrocarbons), CO (carbon monoxide), NOX (nitrogen oxides). Particulate and organic, adsorbed compounds were also measured. For a 3000-lb vehicle, it is concluded that emission targets equal to 0.41 g/mi HC, 3.4 g/mi CO, 2 g/mi NOX, and .7 g/mi particulate are achievable with the NA, IDI diesel engine; EGR is useful in lowering NOX (to less than 1.5 g/mi), but increases particulate emissions. Oxidation catalyst appears to offer levels of 0.41 g/mi HC, 3.4 g/mi CO, and 1.5 g/mi NOX with a particulate level of 0.7 g/mi, if a diesel fuel with low sulfur content is used. Turbocharging appears to be a good approach to achieve low gaseous emission levels of 0.41 g/mi HC, 3.4 g/mi CO, and 1.5 g/mi NOX with lower particulate emissions (less than 0.4 g/mi) CO, and 1.5 g/mi NOX are reasonable achievable with particulates less than 0.6 g/mi. Turbocharging plus EGR plus oxidation catalyst permit these same figures to be achieved more easily if a diesel fuel with low sulfur content is used, and also decrease the organic emissions.

by C. Bassoli; G. M. Cornetti; G. Biaggini; A. Di Lorenzo  
Fiat Res. Centre, Turin, Italy; IVECO Engineering, Turin, Italy; C.N.R., Combustion Res. Lab., Naples, Italy  
DOT-TSC-1424

Publ: HS-026 352 (SAE-SP-442), "Turbochargers and

Turbocharged Engines," Warrendale, Pa., 1979 p59-77

Rept. No. SAE-790316 ; 1979 ; 11refs

Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.

Availability: In HS-026 352

HS-026 358

**TURBOCHARGERS FOR THE 1980'S--CURRENT TRENDS AND FUTURE PROSPECTS**

The requirements placed on turbocharging systems in the very different applications of automobiles (gasoline and diesel), trucks, and off-highway vehicles are reviewed. The developments that will be required in the 1980's are highlighted, together with an analysis of current limitations and future potential. Prospective developments relate not just to turbocharging, but to matching, system design, and maximizing exhaust gas energy utilization. For the near future, development on trucks and off-highway vehicles at modest ratings will continue, with emphasis on wide flow-range compressors, efforts to increase low-speed boost, and better detail design of port and manifold systems. In the near future, the number of turbocharged gasoline engines will increase, although long-term success depends on their com-

parative cost-effectiveness as a fuel economy measure; this is likely to require a major breakthrough in production costs. The ceramic, variable-geometry turbine is the ideal for this application, if it can be developed to achieve reliability at low cost. More certain is the route of small turbocharger applications to passenger car diesel engines, particularly in Europe; these can benefit from developments aimed at the gasoline engine. In the U.S., stringent exhaust emission legislation is offset by the economies of larger production runs on each engine build. The high break mean effective pressure engine also presents problems to the turbocharger manufacturers; high-pressure ratio turbomachinery is required with wide flow range, good efficiency, and durability. Problems encountered with such single-stage turbocharging such as inadequate low-speed torque, poor driveability, and matching for operation at altitude, may be avoided by introducing two-stage systems. In all applications, more emphasis is expected on detail design of all components in the total turbocharging system, including valves, ports, manifolds, and exhaust systems, as well as the turbocharger itself.

by N. Watson

Imperial Coll. of Science and Technology, Dept. of Mechanical Engineering, London, England

Publ: HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines," Warrendale, Pa., 1979 p81-96

Rept. No. SAE-790063 ; 1979 ; 23refs

Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.

Availability: In HS-026 352

HS-026 359

#### VARIABLE AREA TURBOCHARGER FOR HIGH OUTPUT DIESEL ENGINES

A program was undertaken to develop, build, and test an advanced turbocharger on the AVCR-1360 air-cooled diesel tank engine for the Army, by Teledyne Continental Motors, and Thermo Mechanical Systems. High-output, turbocharged diesel engines require efficient air-delivery systems with high pressure ratio, broad range, and surge-free compressors of very high efficiency, as well as high-efficiency turbines with variable stators, in order to maintain high turbine speed when engine speed and airflow are low. The turbocharger developed to meet these goals has a backswep centrifugal compressor with a wedge-type moveable vane diffuser for surge control and a radial inflow turbine with individually pivoted nozzle vanes for inlet flow-area control. After several design iterations and bench tests, extensive engine tests were conducted to demonstrate the substantial improvements in diesel engine performance that are attainable with these turbochargers. A peak engine torque of 3650 ft lb (4949 Nm) has been demonstrated by the AVCR-1360 engine equipped with variable-area turbocharger (VAT), compared to peak torque of 3120 ft lb (4230 Nm) for the base engine. The target torque rise at 1600 rpm of 20% above the rated 3050 ft lb (4135 Nm) has been achieved. The system has the capability of running at the full-speed rated torque at 50% engine speed. The VAT-EQUIPPED engine has a peak of 1660 gross brake hp (1228 Kw) at the rated 2600 rpm vs. 1500 (1110 Kw) for the base engine. Brake specific fuel consumption (BSFC) at the rated point has been demonstrated at .390 lb/GBHP-HR (237.2 g/Kw hr), about a 10% improve 5% improvement. Steady-state smoke observations indicate substantial smoke reduction. VAT durability has been demonstrated to a limited degree (about 700 hr of turbocharger operation without major failures).

by S. G. Berenyi; C. J. Raffa

Teledyne Continental Motors, General Products Div., Muskegon, Mich.; Army Tank Automotive Res. and Devel. Command, Warren, Mich.

Publ: HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines," Warrendale, Pa., 1979 p97-112

Rept. No. SAE-790064 ; 1979 ; 5refs

Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979. Research sponsored by Army Tank Automotive Res. and Devel. Command. See also HS-026 361.

Availability: In HS-026 352

HS-026 360

#### THE EFFECT OF COMPRESSOR AND TURBINE SPECIFIC SPEED ON TURBOCHARGER EFFICIENCY AND ENGINE PERFORMANCE

In a technique for optimizing turbocharger design, calculations demonstrate the effect of decreasing turbocharger component specific speeds on overall turbocharger efficiency. It is concluded that an overall turbocharger efficiency greater than 70% is obtainable for low specific-speed compressors and turbines, an improvement of at least ten points above the overall turbocharger efficiency of the best of current machines and 15 points above more typical modern designs. Since two points improvement in overall turbocharger efficiency corresponds to approximately one point in engine efficiency, an improvement in engine efficiency or specific fuel consumption in the order of five to seven points appears possible. The price of large, low specific speed turbochargers for vehicular diesel engines is not known since vehicular turbochargers of this size have not been built. Larger turbochargers will present installation problems in many vehicular applications, and their rotary inertia will be greater than current designs. Although this will have an effect on the transient performance of the turbochargers, the decrease in transient performance may be reduced by the improvement in component efficiency.

by Wilbur Allan Spraker, Jr.; Cheng-Chien Chou  
Wallace Murray Corp., Schwitzer Div., Indianapolis, Ind.

Publ: HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines," Warrendale, Pa., 1979 p113-8

Rept. No. SAE-790065 ; 1979 ; 10refs

Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.

Availability: In HS-026 352

HS-026 361

#### CENTRIFUGAL COMPRESSOR DEVELOPMENT FOR A VARIABLE AREA TURBOCHARGER

A variable-geometry diffuser was developed for a centrifugal compressor with the objective of meeting the surge regulation and airflow requirement of the Army's advanced AVCR-1360 air-cooled diesel tank engine. The program involved the combined design and development activities of Teledyne Continental Motors (General Products Div.), Power Dynetics, Inc., and Thermo Mechanical Systems. Two types of compressor rotors were built and tested (a radial-blade impeller and a backswep impeller). Results of the performance test program indicated that the variable-geometry compressor met the range and efficiency goals over most of the required operating conditions. The backswep impeller was found to be superior to the radial blade impeller over the entire operating map. Compressor efficiencies as high as 80% were demonstrated in the high airflow operating regime (rated engine speed). At very low airflow corresponding to the lowest engine speed operation, the onset of impeller stalling caused an efficiency loss. It is believed that th

complexity of variable geometry is justified where maximum efficiency and range are mandatory. Continued development of the variable-diffuser, backswept compressor is necessary to upgrade the efficiency at the engine idle speed condition (1000 rpm). Such a development program should include inlet and impeller geometry changes, diffuser system refinements, and turbocharger modifications designed to increase the design specific speed of the variable-area turbocharger.

by James L. Harp; Thomas P. Oatway  
Thermo Mechanical Systems Co., Canoga Park, Calif.;  
Lockheed California Co., Burbank, Calif.  
Publ: HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines," Warrendale, Pa., 1979 p119-27  
Rept. No. SAE-790066 ; 1979 ; 3refs  
Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979. Research sponsored by Army Tank Automotive Res. and Devel. Command. See also HS-026 359.  
Availability: In HS-026 352

HS-026 362

### **SERIES TURBOCHARGING--A REQUIREMENT FOR HIGH SPECIFIC OUTPUT, VEHICULAR DIESEL ENGINES**

In view of the problems associated with obtaining broad compressor range and efficiency at high pressure ratio and the ever-present requirements for durable, low-cost, and low-inertia turbochargers, the performance benefits derived from series (two-stage) turbocharging as applied to high-speed vehicular diesel engine applications are examined. The efficiency, compressor range, transient response, and pressure ratio characteristics of series turbocharging are compared and contrasted to those of single-stage turbochargers. This comparison is fundamental because, in the size class of interest, no high pressure ratio turbochargers are currently in production. It is concluded that it is practical to use existing vehicular turbocharger technology to satisfy, at least in the near term, the demand for higher pressure ratio turbocharger capability. The present-day turbocharger, in volume production, can supply the building blocks for series turbocharger systems.

by Keith G. Rochford  
Garrett Corp., AiResearch Industrial Div.  
Publ: HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines," Warrendale, Pa., 1979 p129-33  
Rept. No. SAE-790067 ; 1979 ; 6refs  
Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.  
Availability: In HS-026 352

HS-026 363

### **ESTIMATING THE INFLUENCE OF PULSATING FLOW CONDITIONS ON THE PERFORMANCE OF A TURBINE**

A new method of estimating turbine performance under nonsteady flow conditions is described, based on the concept of "mean effective turbine expansion ratio" (m.e.t.e.r). The m.e.t.e.r concept is defined as that average expansion ratio which, when assumed to exist across a turbine working under nonsteady flow conditions, gives the "actual" turbine power, with other parameter values being time average values and the isentropic efficiency being a function of this average expansion ratio. A digital computer program to evaluate the "pulse factor" is presented; the pulse factor is evaluated to predict the turbine performance under nonsteady flow conditions when the performance under steady flow is known. This factor takes into account the vari-

ations in expansion ratio, mass flow rate, turbine inlet temperature, and turbine nominal efficiency due to nonsteady flow and is a linear function of mass flow parameter for a constant pulse frequency. The estimation method has been used successfully in real-time digital, hybrid, and analog computer simulations for predicting transient performance of a turbocharged diesel engine. Good agreement was found between predicted and test-bed results.

by S. S. Shamsi  
Pakistan State Oil Co., Ltd., Karachi, Pakistan  
Publ: HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines," Warrendale, Pa., 1979 p135-8  
Rept. No. SAE-790068 ; 1979 ; 7refs  
Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.  
Availability: In HS-026 352

HS-026 364

### **HELMHOLTZ TUNED INDUCTION SYSTEM FOR TURBOCHARGED DIESEL ENGINE**

A tuned intake induction system using a Helmholtz resonator was applied to an in-line, 6-cylinder, 4-cycle, heavy-duty diesel engine, the system being designed to minimize the engine breathing performance at the peak torque engine speed. Significant advantages of this system were 12% improvement in volumetric efficiency, improved cylinder-to-cylinder air distribution, and faster turbocharger response. The increased trapped air-fuel ratio also resulted in improved combustion efficiency and reduction of smoke emissions. Additional improvements appear feasible by compressor redesign and optimization of valve timing. The primary disadvantages are the additional space requirement and corresponding installation difficulties, but compact designs can be achieved without great difficulty. The tuned intake resonator offers a means of improving the engine airflow characteristics by economical means. It performs this function without undue system complexity, moving parts, or the need for a control system. These attributes make its incorporation possible without compromising the reliability or durability of the powerplant.

by M. C. Brands  
Cummins Engine Co.  
Publ: HS-026 352 (SAE-SP-442), "Turbochargers and Turbocharged Engines," Warrendale, Pa., 1979 p139-47  
Rept. No. SAE-790069 ; 1979 ; 4refs  
Presented at Congress and Exposition, Detroit, 26 Feb-2 Mar 1979.  
Availability: In HS-026 352

HS-026 365

### **SILENCER DEVELOPMENT AT TI CHESWICK SILENCERS [MUFFLERS]**

Development approach, activities, and test facilities for exhaust systems at TI Cheswick, a British firm, are described. The general approach to muffler development is one of allowing the exhaust gases to expand into chambers of large cross-sectional area. Expansion of the relatively low frequency wave fronts, successively, into volumes adding up to one-third capacity (use of expansion chambers) is general practice. "Roughness" following in the wake of the wave front is reduced by use of louvered tubes within closed portions of the muffler; these tubes act as Helmholtz resonators to attenuate the high frequencies. One peak frequency in the combustion exhaust spectrum, called "boom", is often dealt with by a separate Helmholtz resonator. Gas-induced noise such as "pipe noise", case rattle, and plate



vibration are usually overcome by such measures as laminated pipes, damped end-plates, increased number of bulkheads, and insulated case structures, while "overrun rasp" is normally treated with a resonator within 1070 mm (42 in) of the exhaust ports, or by passing the gas through an "absorption chamber" prior to expansion. TI Cheswick is also involved in the production canning of catalytic converters and in the development and testing of other promising pollution control devices. Latest systems are three-way catalytic converters; for the 1980 model year, oxygen sensors are to be fitted, with electronic computer control of the engine air-fuel ratio. New systems are tested on thermal cycling and thermal vibration rigs, with successful designs proceeding to engine dynamometer and on-car trials. Current units are made on company-designed, special-purpose machines. Parallel development work has been carried out on "lean burn" thermal reactors designed to replace conventional exhaust manifolds. The company, jointly with Texaco and Associated Octel, has developed a lead particulate filter for reducing lead emissions, and is developing a diesel particulate filter.

Publ: Automotive Engineer v4 n2 p43-5 (Apr-May 1979)  
1979 ; 2refs  
Availability: See publication

HS-026 366

### HEAVY DUTY DIESEL PARTICULATE EMISSION FACTORS

In an Environmental Protection Agency program over the past several years, particulate emissions have been measured from a variety of heavy-duty diesel engines. Samples have been collected by Southwest Res. Inst. using an exhaust splitter to divert a fraction of the engine exhaust into a standard dilution tunnel. A small fraction of the diluted exhaust from the tunnel is pulled through a filter from which particulate mass and, in some cases, organic content of the particulate is determined. The sampling system is discussed, and particulate emission factors are given that have been computed from truck and bus fuel consumption data. Average truck and bus speed data from New York and Los Angeles (freeway and nonfreeway usage) are also provided. Average particulate emission test results (steady-state tests) for 2-stroke engines are 4.74 g/kg fuel, and 2.64 g/kg fuel for 4-stroke engines. Using average particulate emissions results, a particulate emission factor range of 0.8 g/km to 1.3 g/km was computed. Nationwide diesel particulate emissions were calculated to be 88,170 metric tons per year (79,850 for trucks, 2750 for intercity buses, and 5570 for local buses).

by Thomas M. Baines; Joseph H. Somers; Craig A. Harvey  
Publ: Journal of the Air Pollution Control Association v29 n6 p616-21 (Jun 1979)  
1979 ; 18refs  
Revised version of paper (No. 78-54.3) presented at 71st Annual Meeting of Air Pollution Control Assoc., Houston, Jun 1978.  
Availability: See publication

HS-026 367

### FUNDAMENTAL STUDIES IN AUTOMATIC VEHICLE CONTROL. INTERIM REPORT

In the first year of a planned three-year program, the research efforts were focused principally on the development of an automated vehicle test facility which would be employed to study control and communication problems at, and below, the sector level. These studies would be focused on the automatic control of high-speed (to 28.1 m/sec), traffic operations at time headways as small as one sec. The primary activities included the

implantation of both lateral and longitudinal information sources at the 6.4-km, skid-pad facility at the Transportation Research Center of Ohio; the specification of a sector-level controller which would be comprised of a commercially available micro-processor and a considerable amount of special-purpose hardware; a study of automatic longitudinal control, both in the normative and emergency modes of operation; the evaluation of a "flattened" helical-line information source for providing continuous position information to each controlled vehicle in a sector; and a study of automatic steering with an emphasis on high-speed, lane-changing operations. Details are presented of the first, third, and fourth activities; the other two will be discussed in two forthcoming papers. The secondary activities included a reevaluation of a headway safety policy for automated highway operations, and the development of a methodology to determine the accident costs associated with a particular policy choice.

by R. E. Fenton; R. J. Mayhan; G. M. Takaski; J. Glimm  
Ohio State Univ., Transportation Control Lab., Columbus, Ohio 43210  
DOT-FH-11-9257  
Rept. No. FHWA-RD-79-42; 784712-1 ; 1978 ; 200p 57refs  
Rept. for Apr 1977-Apr 1978.  
Availability: NTIS

HS-026 368

### PIERCING THE DRIVER LICENSE VEIL [NON-USE OR MISUSE OF THE NATIONAL DRIVER REGISTER IN ISSUING LICENSES]

Although most states participate in the National Driver Register (NDR) to some degree, four states (California, Florida, Massachusetts, and New York) issue about 25% of the driver's licenses in the U.S. with little or no prior use of the NDR. The NDR is a voluntary, cooperative Federal-state project providing a source of data which states can utilize to determine if persons applying for or renewing driver's licenses have had their driving privileges suspended or revoked in other jurisdictions. State laws prohibit issuing a license to a person while his license is withdrawn in another jurisdiction. Failure to use the Register raises the question whether the states are liable for damages if a driver who should not have been licensed is involved in a crash. A review is given of the reasons offered by the aforementioned states for not making full use of the NDR, and a commentary provided on the potential liability of these states.

by Andrew R. Hricko  
Publ: Federation of Insurance Counsel Quarterly v29 n2 p175-84 (Winter 1979)  
1979 ; refs  
Reprinted and distributed by Insurance Inst. for Hwy. Safety, Watergate 600, Washington, D.C. 20037  
Availability: See publication; Insurance Inst. for Hwy. Safety

HS-026 369

### INVESTIGATION OF THE INFLUENCE OF VARIOUS BRAKING REGULATIONS ON ACCIDENT AVOIDANCE PERFORMANCE. FINAL TECHNICAL REPORT

Passenger car braking regulations promulgated by the United States and various European countries were analyzed to determine the incompatibilities in brake proportioning that derive from the performance requirements of the regulations. Two vehicles were considered, one produced in the U.S. and the



other in Europe, with extreme loading conditions (as derived from option selection and vehicle loading). The analysis shows that the European regulations (United Nations Economic Commission for Europe Regulation 13, Common Market European Economic Community Directive 71/320, Swedish regulation F-18) require a larger forward bias in brake proportioning than FMVSS (Federal Motor Vehicle Safety Standard) 105-75. Computer simulations were used to predict the following differences in braking performance which result from proportioning the example vehicles to comply with the different regulations: conditions of straight-line braking, braking in a turn, and three surface friction levels. In general, both vehicles were capable of achieving shorter stopping distances when proportioned to meet FMVSS 105-75 than when proportioned to comply with the European regulations, but the differences are considered trivial with respect to the ordinary driver. When proportioned to meet FMVSS 105-75, the rear wheels of the two study cars sometimes locked up first, a result that the European regulations are designed to prevent. Braking-in-a-turn test procedures (which have been discussed both in the U.S. and abroad) were also studied through computer simulations and found to be relatively insensitive to the fore-aft proportioning of brake torques.

by M. Sayers; L. Segel  
University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy.  
and Baxter Rd., Ann Arbor, Mich. 48109  
Rept. No. UM-HSRI-78-51; PB-291 748 ; 1978 ; 155p 27refs  
Rept. for 1 Jul 1977-31 Oct 1978. Sponsored by Motor Vehicle  
Manufacturers Assoc.  
Availability: NTIS

HS-026 370

#### **A DIGITAL ELECTRONIC SHIFT SCHEDULE CONTROL FOR VEHICULAR AUTOMATIC TRANSMISSIONS**

A digital transmission shift schedule control has been developed which measures throttle position and vehicle speed to determine the proper gear ratio based on preprogrammed upshift and downshift schedules. Five- and six-bit vehicle speed and three- and four-bit throttle position resolutions have been evaluated. Throttle position was measured with an experimental variable-reluctance device (variable-frequency oscillator), located above the throttle position; vehicle speed was measured by a magnetic pickup from a toothed wheel on the transmission output shaft. The electronic control system has been evaluated for over 4000 mi under city, highway, sea-level, and high-altitude conditions. It has been demonstrated to be a viable method of scheduling the shift points of a transmission and represents a likely first step in the conversion of transmissions to electronic control. The best compromise resolution for vehicle speed would probably be a five-bit signal with full scale at 85 mph. The same speed signal would be used for 1-2 and 2-3 shift schedule. This would provide approximately 2.7 mph increments for both the 1-2 and 2-3 shift schedules. The best compromise resolution for throttle position would probably be a three-bit nonlinear signal. Every attempt should be made to minimize the number of external wiring connections, as the only durability/reliability problems encountered were with electrical connectors. The control should be integrated with a speedometer display and cruise control, thus eliminating all mechanical vehicle speed measurement.

by G. L. Casey  
Bendix corp.  
Rept. No. SAE-790044 ; 1979 ; 11p 2refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 371

#### **COIL SPRING SERVICE**

Diagnostic and servicing information is provided for the automotive service specialist concerning coil spring components of a suspension system. The design of a suspension system to work around a basic vehicle height, and the effect of sagging coil springs on alignment angles (and thus on tires and handling) are discussed. Badly sagged coil springs must be replaced to restore the car to the original ride height so the wheels can be properly aligned. Tips for measuring vehicle ride height as a diagnostic technique are given. Step-by-step procedures (and accompanying photographs) are provided for servicing coil springs mounted on upper control arms, on lower control arms, on twin axles, and on rear axles. In separate sections, general servicing tips are outlined, and a job cost comparison for a 1974 Chevrolet Impala is made among coil spring servicing, minor engine tuneup, minor brake job, and shock absorber tuneup.

by Ken Zino  
Publ: Motor v151 n6 p40-4, 46, 48 (Jun 1979)  
1979  
At head of title: Motor Clinic Series.  
Availability: See publication

HS-026 372

#### **STEP TO THE REAR [REAR AXLE SERVICING]**

Information is provided for the automotive service specialist for diagnosing and correcting rear axle assembly problems. Instructions are given for a thorough test of a vehicle in order to isolate the source of the problem noise, and the characteristics of the two general types of rear axle noise (gear and bearing) are described. Step-by-step procedures are outlined for disassembling rear axle assemblies; information is provided for inspecting, reassembling, and making final adjustments. Differences between the two types of axle carriers (integral and removable) are indicated; the different components of the two types are illustrated, as well as their adjustment points. The final road test (the first one having taken place in the diagnostic stage) is described. A rear axle IQ test of 15 questions with multiple-choice answers is included, and correct answers provided.

by Mike James  
Publ: Motor v151 n6 p51-4, 56, 58, 78 (Jun 1979)  
1979  
Availability: See publication

HS-026 373

#### **CLOSING THE LOOP [ELECTRONIC EMISSION CONTROL SYSTEM]**

General Motors has a new emission control system, the Computer Controlled Catalytic Converter (C-4), which is used in California on some 1979 3.8-L V6's, 1980 2.5-L L4's, and 2.8-L V6's. The purpose of the C-4 system is to maintain the air-fuel ratio at the level where the 3-way catalyst is most effective. A bonus of the system is that it prevents the excessively lean mixtures that cause poor driveability. If the C-4 malfunctions, a built-in self-diagnostic system flashes a CHECK ENGINE light on the dashboard. The technician then grounds a trouble code test lead, and a number indicating the problem area flashes. A dwellmeter, ohmmeter, test light, digital voltmeter, tachometer, vacuum gauge, and jumper wires are the only tools needed to diagnose the system. The C-4 will keep a record of anything that goes wrong while the car is in use, and this memory can be queried when the car is brought into the shop. Among the

features of the C-4 are an electronic control module, coolant temperature sensor, electronically controlled carburetor, and a distributor advance-retard system.

by Mark Emerton

Publ: Motor v151 n6 p31-2, 35-6, 38 (Jun 1979)

1979

Availability: See publication

HS-026 374

#### **NBR VULCANIZATES RESISTANT TO HIGH TEMPERATURE AND "SOUR" GASOLINE**

Cadmium oxide and zinc oxide activated low-sulfur cures and peroxide cures of NBR or poly(butadiene-co-acrylonitrile), with physical properties suitable for use in fuel-line hose tube, were compared with a compound typical of those now used in fuel-line hose to examine their resistance to aging by gasoline containing hydroperoxides ("sour" gasoline). NBR compounded in a conventional fuel hose tube formulation was found to be degraded markedly by sour gasoline or sour ASTM Fuel C within 7 days at 40 degrees C. The conventional NBR compound was not resistant to aging at 125 degrees C. Use of an NBR designed for heat-resistant compounding and an appropriate choice of compound greatly improved resistance to fuel which contained hydroperoxides. The preferred system for sour gasoline resistance and resistance to long-term aging at 125 degrees C is a cadmium-activated, low sulfur-sulfur donor compound with silica as the principal filler. This vulcanizate is not much more affected after 7 days at 40 degrees C by gasoline of peroxide number 50 than by clean gasoline, and is less affected by gasoline of peroxide number 200 than are other NBR vulcanizates. The balance of high- and low-temperature properties can be optimized by appropriate choice of plasticizer and acrylonitrile level. Aging resistance is improved somewhat by increase in acrylonitrile level, and fuel permeability is decreased markedly. Permeability to gasoline with 30 aromatic content can be changed appreciably by compounding, but the resistance to Fuel C with 50% aromatic content does not appear to respond to compounding changes. The stability of NBR vulcanizates in sour gasoline is reduced by copper salts and, to a lesser extent, by metallic copper. Bound antioxidant NBR does not appear to offer an advantage in sour gasoline resistance over heat-resistant NBR compounded in a comparable formulation.

by J. R. Dunn; H. A. Pfisterer; J. J. Ridland

Publ: Rubber Chemistry and Technology v52 n2 p331-52 (May-Jun 1979)

1979 ; 10refs

Presented at meeting of Rubber Div., American Chemical Society, Boston, 10-13 Oct 1978.

Availability: See publication

HS-026 375

#### **FHWA HIGHWAY TRAFFIC NOISE PREDICTION MODEL. FINAL REPORT**

The Federal Hwy. Administration method is described for predicting noise generated by constant-speed highway traffic. The report is designed as a users' manual and as a reference document, detailing the development, use, and limitations of the prediction method. The prediction procedure is presented, step-by-step, with example problems for highlighting important concepts and features. Appended is a detailed derivation of the model. The basis of the model is the equivalent sound level (Leq), although an adjustment for conversion to L10 is provided. Three classes of vehicles are included: automobiles,

medium trucks, and heavy trucks. Adjustments for absorptivity, ground covers and finite-length barriers are also included, as are certain special topics, such as nonuniform highway sites and determination of equivalent day-night levels (Ldn).

by T. M. Barry; J. A. Reagan

Federal Hwy. Administration, Washington, D.C. 20590

Rept. No. FHWA-RD-77-108 ; 1978 ; 275p 12refs

Rept. for Jun 1977-Dec 1978.

Availability: NTIS

HS-026 376

#### **INITIAL EXPERIENCE WITH A DRIVER IMPROVEMENT PROGRAM FOR TRAFFIC OFFENDERS WITH ALCOHOL-RELATED PROBLEMS (ERSTE ERFAHRUNGEN MIT EINEM DRIVER-IMPROVEMENT-PROGRAMM FUR ALKOHOLAUFFALLIGE VERKEHRSSTRAFTATER)**

Initial experience with a driver improvement program for problem drivers is reported, the program oriented toward changing driver attitude and behavior. The program is based primarily on learning theory and applies such methods as behavioral analysis and self-control techniques. The program consists of four 2- to 2-1/2-hr sessions with small groups, with individual sessions at the beginning and conclusion of the program. The main topics of the course include the following types of driver impairment: underestimation of the hazardousness of certain traffic offenses, overestimation of one's driving capability, underestimation of the detrimental effects of alcohol, and inappropriate estimation of the consequences of one's behavior. Initial experience in testing the program involved a group of 25 male offenders with an average age of 30, almost all having been involved in alcohol-related accidents involving personal injury. Participant response, psychologists' evaluation, and comparison of personality and attitude questionnaire results before and after the group session indicate promise for the driver improvement program.

by E. Klebel; H. Michalke; L. Schmidt

Publ: Zeitschrift fur Verkehrsrecht v23 special issue p77-89 (1978)

1978 ; 43p 24refs

Special Reprint, translated from German (original 14p; translation 29p). Slightly abridged version of unpublished research report, "Driver Improvement-Initial Experience with Group Training for Traffic Offenders BMWF and BMJ with financial support of Nationalbank (Austria), with Alcohol-Related Problems," Vienna, July 1977. Research sponsored by

Availability: Reference copy only

HS-026 377

#### **APPRAISALS OF VISIBILITY ON LIGHTED DRY AND WET ROADS**

A study was made of the changes of visibility conditions on wet lighted roads compared with those on dry lighted roads, and to examine the possibility of adapting luminance design methods to the wet state. Considerable deterioration in the visibility of objects was found for the wet vs. the dry condition, but often the deterioration was not confirmed by observer subjective appraisals. The extension of luminance design methods to the wet state was found impossible. It is concluded that road lighting quality appraisals should be based directly on research studies of visibility on roads.

by P. Gordon

Publ: Lighting Research and Technology v9 n4 p177-88 (1977)

1977 ; 7refs

Availability: See publication

HS-026 378

**TRAFFIC SAFETY IN HIGHWAY CONSTRUCTION ZONES. PT. 1--PROBLEMS AND IMPROVEMENTS**

A review of several studies comparing accident experience before and during highway construction activity demonstrates that there continues to be a traffic safety problem associated with construction zone traffic control practices. One method of improving traffic safety near construction is the effective planning and design of construction zones; the first two of five logical steps in this approach are outlined: determining basic conditions, and selecting basic zone type and scheduling. The basic conditions have to be identified by obtaining construction data (lateral location, length, and expected duration of construction), roadway data (e.g. cross section, number and width of lanes, shoulder width, roadside obstacle clearance, median width, horizontal and vertical alignment), and traffic data (e.g. traffic composition and volume, vehicle speeds). Selecting the basic zone type involves separating traffic and construction activity in space and/or time. Space separation is accomplished by one of the following zone types: lane closure, crossover, temporary bypass, detour, or roadside work zone. Separation in time is accomplished by restricting either traffic or construction activity time. Entering what is covered in another item creates false drops.

by Robert Paulsen; John Glennon; Douglas Harwood; Jerry Graham

Publ: Rural and Urban Roads v16 n10 p56-8 (Oct 1978) 1978 ; 1ref

Abridged version of paper presented at 57th Annual Meeting of Transportation Res. Board, 17 Jan 1978. Pt. 2. Speed Control Strategy, is HS-026 379.

Availability: See publication

HS-026 379

**TRAFFIC SAFETY IN HIGHWAY CONSTRUCTION ZONES. PT. 2--SPEED CONTROL STRATEGY**

The last three steps in the effective planning and design of highway construction zones are outlined formulating speed control strategy, determining geometric design elements, and selecting traffic control devices and methods, and the effective management and operation of construction zones are discussed. The two main philosophies of speed control are maintenance of normal speed, and reduction of speed. Once the speed control strategy has been chosen, the construction travelway should be designed according to the geometric design standards required for the traffic speed; several principles to be followed in geometric design are outlined. The fifth and final planning and design step is the selection of appropriate traffic controls; their appropriate use is described, as well as several new devices developed to control traffic through construction areas. Zone management is discussed in terms of advance public warning, personnel training, zone operation evaluation, removal or alteration of inappropriate traffic controls and signs, movement of warning signs to keep pace with construction activity, and maintenance of traffic devices.

by Robert Paulsen; John Glennon; Douglas Harwood; Jerry Graham

Publ: Rural and Urban Roads v16 n11 p53-5 (Nov 1978) 1978 ; 20refs

Digest of a presentation at 57th Annual Meeting of Transportation Res. Board, 17 Jan 1978. Pt. 1, Problems and Improvements, is HS-026 378.

Availability: See publication

HS-026 380

**THE DIESEL DILEMMA; EPA'S ENVIRONMENTAL PROTECTION AGENCY DIFFICULT DECISION**

The future of the diesel car is discussed in terms of its particulate emissions and their potential carcinogenicity. In light of inconclusive findings of laboratory studies conducted by the Environmental Protection Agency (EPA) on the carcinogenic effects of diesel exhaust, both EPA and the auto industry (General Motors in particular) are increasing their research efforts. When some preliminary results will be available at the end of 1979, the EPA Administrator will decide, based on possibly very meager data, whether to allow or to ban continued production of diesel passenger cars. The diesel gets about 25% better fuel economy than the standard gasoline engine, but faces a problem in meeting emission standards. Particulate matter, nearly 0.5 kg/1000 mi of city driving, is the major emission concern. These bits of aggregated carbon (common soot) not only create odor and visibility problems but nearly 95% of them are coated with potentially harmful hydrocarbons. These particles are presently unregulated, although a standard has been proposed and may be promulgated by EPA at the end of 1979. Despite the lack of any successful particle-control technology, and the existence of many unanswered health questions, especially preliminary evidence that diesel particles may cause cancer, industry is tentatively moving ahead. The few epidemiological studies to date have not demonstrated direct links between diesel exhaust components and cancer nor have they vindicated diesel emissions. EPA will probably tell industry that there is insufficient evidence on which to ban diesels but that, in order to continue to produce diesel cars, industry must meet a particulate emissions standard (likely to be 0.6 g/mi for 1981 model year cars). Despite GM'S recent protests to the contrary, this standard can be met by diesel manufacturers, although not easily. Although the 0.6 g/mi standard may not be adequate to protect public health, EPA can still appear to be doing something about public health.

by Lois Ember

Publ: Environment v21 n2 p16-20, 38-41 (Mar 1979) 1979 ; refs

Availability: See publication

HS-026 381

**A FUNDAMENTAL CONSIDERATION ON SHIFT MECHANISM OF AUTOMATIC TRANSMISSION**

A new shift mechanism for three- or four-speed automatic transmissions, compact in design and having a better shift quality, has been designed which consists of a single planetary gear set, two clutches, and an overrunning clutch mounted on the planetary input member. The ring gear member is detached from the turbine member by the overrunning clutch during the power-off upshift and the power-on downshift; it is therefore easy to control the timing of clutch engagement and disengagement. Refinement of the shift control method involves a shift valve for controlling the hydraulic pressure applied to the clutches and two timing valves for controlling the engagement/ disengagement timing. Theoretical and experimental studies have demonstrated that the new shift mechanism provides a better shift quality, and that the shift characteristics are remarkably affected by the vehicle vibration system, especially the torsional vibration of rear axles, the axle windup, and the engine fore and aft vibration. The new mechanism has been successfully applied to a Toyota four-speed automatic transmission with overdrive.

by Yoshio Shindo; Hiroshi Ito; Tomo-o Ishihara  
Toyota Motor Co., Ltd., Japan; University of Tokyo, Japan  
Rept. No. SAE-790043 ; 1979 ; 14p 7refs  
Technical Paper Series. Presented at Congress and Exposition,  
Detroit, 26 Feb-2 Mar 1979.  
Availability: SAE

HS-026 382

### A HEADWAY SAFETY POLICY FOR AUTOMATED HIGHWAY OPERATIONS

The maximum capacity, cost, and safety of an automated highway system are largely dependent on the selected headway policy, i.e. the specification of a minimum acceptable headway (as a function of speed) for mainline operations. A policy, designed to avert collisions due to "reasonable" lead-car decelerations, is presented and evaluated in the context of achieving high capacity (greater than or equal to 3600 vehicles/lane/hr) over a range of typical highway speeds (13.5 m/sec to 30 m/sec (30.2 mi/hr to 67.2 mi/hr)). A detailed analysis was made to determine both the relationships among, and the requirements on, seven parameters requisite to this policy which pertain to systems-level operations, the capabilities of a vehicle's automatic control system, and the vehicle/roadway interface. The tradeoffs associated with safety, capacity, and cost (in the form of required future development efforts) are identified, and three general approaches to selecting parameters for an operational system are specified.

by Robert E. Fenton  
Publ: IEEE Transactions on Vehicular Technology vVT-28 n1  
p22-8 (Feb 1979)  
1979 ; 10refs  
Sponsored by Federal Hwy. Administration. Presented at 28th  
IEEE Vehicular Technology Conference, Denver, 22-24 Mar  
1978.  
Availability: See publication

HS-026 383

### "SAFE-APPROACH" VEHICLE-FOLLOWER CONTROL

A "safe-approach" operating policy for automated guideway transit systems is presented which specifies velocity/spacing relationships for dynamic string operation. This policy is compared with steady-state policies such as constant time headway, constant separation, and constant K-factor. It is shown that only the safe-approach operating policy is consistent with collisionless service maneuvers. A description is given of how such a safe-approach policy can be used to implement vehicle longitudinal control systems. An example control system is discussed, which uses a basic velocity control loop for all overtaking and headway control operations. Simulation results are included to demonstrate the performance of this design. Ways are discussed in which the safe-approach policy may be further extended to handle emergencies and merge/diverge operations.

by Sidney J. Sklar; John P. Bevans; Gunter Stein  
Publ: IEEE Transactions on Vehicular Technology vVT-28 n1  
p56-62 (Feb 1979)  
1979 ; 4refs  
Availability: See publication

HS-026 384

### ATTITUDES OF VIRGINIANS TOWARD TRANSPORTATION SAFETY. RESULTS OF THE 1978 TRANSPORTATION SAFETY PUBLIC OPINION POLL. FINAL REPORT

In Oct and Nov 1978, approximately 2000 randomly selected Virginia families were called and a member of each household over the age of 16 was asked his opinion on various transportation safety issues. About 80% of the respondents felt that persons convicted of drunk driving would benefit from an alternative treatment program. A slight majority (53%) favored a drinking age (for beer) of 18, with about 27% preferring 21 years; slightly more preferred 21 years to 18 years as the restriction for wine. An overwhelming majority (about 90%) felt that driver education should be a prerequisite for obtaining a license before turning 18. A majority (74%) favor the maintenance of a 55 mph speed limit. A majority (86%) was found to approve of periodic motor vehicle inspection. Over 90% of the respondents (and over 76% of motorcyclists polled) were in favor of mandatory helmet use by motorcyclists. Only 33% of the respondents favored a mandatory seat belt usage law (a figure lower than in a 1977 survey), but more people (55%) than in the previous year favored mandatory installation of passive restraints. Of the respondents, 60% felt that adequate progress had been made in improving highway safety. The most common stated cause of railroad crossing accidents was dangerous practices by motorists.

by Cheryl Lynn  
Virginia Hwy. and Transportation Res. Council, Charlottesville, Va.  
Rept. No. VHTRC-79-\*R51 ; 1979 ; 47p 9refs  
Sponsored by Virginia Dept. of Transportation Safety.  
Availability: Virginia Dept. of Transportation Safety

HS-026 385

### SURVEY OF CHILD RESTRAINTS IN AUSTRALIA. [N.R.M.A. REPORT NATIONAL ROADS AND MOTORISTS ASSOCIATION]

Results are presented of a 1977 survey of Australians (via questionnaires in Australian Automobile Assoc. member journals) aimed at assessing possible major problems with various types of child restraints (including differences between Australian Standard AS 1754 and E46 restraints), and the effectiveness of restraints in accidents. A total of 817 questionnaires were received, providing information on 1349 restraints (858 seats, 381 harnesses, 110 bassinets). Over three-fourths of the child seats and harnesses were found to have been approved under one standard or the other. Only 3 children were reported to have been injured in the 155 accidents reported; in all but two cases, the restraints were considered to have performed satisfactorily. Forty percent and 20% of child harnesses and seats, respectively, presented difficulty in transferring from one vehicle to another. More difficulty was encountered moving child seats with their own anchorage straps than those using adult lap-sash harnesses. Forty percent and 23% of seats and harnesses, respectively, were difficult to adjust; 24% and 35%, respectively, allowed excessive child movement. There were fewer problems with seats approved to the new Standard AS 1754. Use of inertia reel seat belts with child seats lacking upper restraining straps did not appear to present any problems where children were able to free arms to unfasten buckles, and that harnesses slipped and straps cut into children. Some cases of inadequate and inadequately supporting seats were reported, as were harnesses which could not be firmly adjusted. Netting, c

and size problems were associated with bassinette restraints. Little difference was found between restraints fitted in sedans and those in station wagons.

by R. G. Cox; D. M. Fleming  
National Roads and Motorists Assoc., Traffic and Safety Dept.,  
151 Clarence St., Sydney 2000, N.S.W., Australia  
1978 ; 34p 2refs  
See also HS-026 386, The Use of Restraints by Children in  
Automobiles.  
Availability: Corporate author (limited quantity)

HS-026 386

#### THE USE OF RESTRAINTS BY CHILDREN IN AUTOMOBILES. N.R.M.A. [NATIONAL ROADS AND MOTORISTS' ASSOCIATION] SURVEY:

Results are presented of an Oct-Nov 1977 survey in which 1300 vehicles containing 1677 children were observed in seven shopping centers in Sydney (N.S.W., Australia) to determine child restraint availability and usage. Restraint systems were available to 85.5% of the children observed (child seats and harnesses to 48.7%, adult lap or lap-sash belts to 36.8%). Only 48.9% of the children wore a restraint (43.8% with a child restraint, 5.1% with an adult restraint), with only 43.5% considered to be adequately protected. The number of unapproved child seats decreased from 104 in a 1976 survey to 69. Although 58.4% of the 6-mo to 4-yr age group were adequately protected, only 19.3% of the 4- to 7-yr age group were so protected. In only 16 of 49 cases had an attempt been made to restrain bassinets. Compared to the 1976 survey, the number of children adequately restrained showed a 10.5% increase, but remains relatively low. The introduction of new child restraint legislation in N.S.W. in Mar 1977 may have encouraged more parents to place their children in the rear seat and to purchase child restraints, but has failed to impress on parents that if no child restraint is available, the child one year of age or older must wear an available adult seat belt.

by D. Fleming  
National Roads and Motorists' Assoc., Traffic and Safety Dept.,  
151 Clarence St., Sydney 2000, N.S.W., Australia  
1977 ; 37p 3refs  
See also HS-026 385, "Survey of Child Restraints in Australia."  
Availability: Corporate author (limited quantity)

HS-026 387

#### ASSESSING THE NATIONAL 55 M.P.H. SPEED LIMIT

The desirability of the new national speed limit is evaluated, using tools of normative and positive economic analysis. The theoretical case for a speed limit is analyzed, and it is concluded that externalities in driving may justify the use of a speed limit, among other policies. The principal costs and benefits of the 55 mph speed limit are discussed, and available data are used in order to suggest reasonable estimates of costs and benefits. A number of conceptual and empirical limitations of the analysis are emphasized. Although the empirical analysis indicates that the benefits of the program outweigh the economic costs, a speed limit appears to be a second or third best policy for achieving both highway safety and fuel conservation goals. Other policies, aimed directly at these goals, might be more effective and could also eliminate the present inequity of penalizing, in terms of time costs, drivers of efficient compacts and gas guzzlers alike. Several possible policies which could be used to replace or, more likely, complement a national speed limit are

gasoline price increases, taxation of cars on the basis of rated fuel consumption, mandatory seat belt usage, and mandatory installation of air bags in new cars.

by Charles T. Clotfelter; John C. Hahn  
Publ: Policy Sciences v9 n3 p281-94 (Jun 1978)  
1978 ; 25refs  
Availability: See publication

HS-026 388

#### BIKE AND CAR ACCIDENTS: PROBLEMS AND COUNTERMEASURES. SOME PRACTICAL ADVICE FOR CYCLIST AND MOTORIST

An in-depth study sponsored by the National Hwy. Traffic Safety Administration of almost 1000 bicycle/motor vehicle accidents in several U.S. states has classified the accidents into 36 problem types, and a brief review is given of 7 types which caused 49% of the fatal and 52% of the nonfatal accidents. The problems, their representation in fatal and nonfatal accidents, and countermeasures are outlined. The accident types include emerging from a driveway without slowing or stopping; failure of bicyclists to slow or stop for stop signs at intersections; motorist entering street from a commercial driveway, stopping and scanning, but failing to see bicycle approaching from left or right; motorist stopping for a stop sign and then hitting cyclists proceeding into or across street that has no stop sign; motorist colliding into the rear of a bicycle going in the same direction (failure to observe bicycle because of darkness, high closing velocity, driver's expectation that road would be clear of bicycles, and inadequate lighting of bicycle); bicyclist riding on right edge of road turns toward left without looking to rear or signaling and collides with overtaking motor vehicle; and motorist turns left into path of bicyclist coming in his direction.

by Fred DeLong  
Publ: Bicycling v19 n12 p56, 58-9 (Dec 1978)  
1978  
At head of title: Bike Law.  
Availability: See publication

HS-027 364

#### MANDATED FUEL ECONOMY STANDARDS AS A STRATEGY FOR IMPROVING MOTOR VEHICLE FUEL ECONOMY

Following an overview of U.S. standards legislation for the three major motor vehicle policy areas (fuel economy, emission control, and safety), a review is presented of the legislative and administrative history of the mandatory fuel economy standards (National Hwy. Traffic Safety Administration rulemaking on fuel economy for passenger cars, 1981-1984, and for light trucks, 1980-1981), and the potential of such standards for achieving further improvements in new car fleet fuel economy is assessed. It is concluded that mandatory fuel economy standards have proved to be a powerful and flexible instrument for increasing motor vehicle fuel economy, and are likely to be employed further. Since it is not possible at the start of rulemaking to assess properly all the impacts of a regulatory decision, continuous reappraisal of proposed standards will be required as new information and knowledge are provided by interested parties. If, in the post-1985 decade, mandatory fuel economy standards are to continue as a useful strategy for fuel economy improvements, they will have to be supported by other Federal policies both to stimulate the marketability of fuel-economy motor vehicles and to mitigate the adverse economic effects on certain industrial sectors, regions of the country, and segments of the work force.

by Richard R. John; Philip S. Coonley; Robert C. Ricci; Bruce Rubinger

Transportation Systems Center, Cambridge, Mass 02142  
 Publ: HS-804 786 (DOT-TSC-NHTSA-79-33), "Workshops on Technological Change in the U.S. Automobile Industry and Symposium on Technology, Government and the Automotive Future, Proceedings," Washington, D.C., 1979 p101-43 1979

46refs

Presented at the Symposium, held in Cambridge, Mass., 19 Oct 1978.

Availability: In HS-804 786

HS-027 365

### BEYOND AUTOCRACY: THE PUBLIC'S ROLE IN REGULATING THE AUTO

A call is made for the Federal government to fund a long-term program to involve the public in transportation policy decisions. It is suggested that the National Hwy. Traffic Safety Administration (NHTSA), for example, expand its demonstration program to support public participation in rulemaking procedures, and that government should encourage the development of a corps of technicians who can evaluate, independently of government and industry, such matters as automobile safety, emissions control, fuel economy, public transportation, and transportation planning and use. It is proposed that the academic community interest itself in such issues as the social impact of the car. The automotive industry's economic clout with the media is seen in need of investigation and reform. It is pointed out that no organized grass-roots movement exists to oppose unregulated automobile production and the auto's indiscriminate use, and there are too few public interest and environmental organizations to compete adequately with the industry's special interest groups. Several major studies on the social impact of the automobile are deemed biased because of special interest overrepresentation. The NHTSA recognition of independent data and its support of public participation in Federal rulemaking procedures are cited. It is felt that the automobile as a consumer product is slowly coming under reasonable regulation. It is emphasized that a major regulatory failure has been the limitation of regulations to standardization of automobile components, and that consideration must also be given to the societal costs of auto-related air and water pollution, congestion, accidents, medical expenses, and government subsidies. The importance of a holistic approach to regulating the auto industry is emphasized, i.e. regulations in terms of the industry's products (through emission and safety standards), and in terms of how its products are used (through comprehensive and open planning processes).

by Brian Ketchum; Stan Pinkwas  
 Citizens for Clean Air, Inc.

Publ: HS-804 786 (DOT-TSC-NHTSA-79-33), "Workshops on Technological Change in the U.S. Automobile Industry and Symposium on Technology, Government and the Automotive Future, Proceedings," Washington, D.C., 1979 p145-79 1979 ; 33refs

Presented at the Symposium, Held in Cambridge, Mass., 20 Oct 1978.

Availability: In HS-804 786

HS-027 366

### TOWARD MORE EFFECTIVE ORGANIZATION FOR PUBLIC REGULATION

The issues of "institutional capacity" and strategy as related to government regulatory agencies and private industry (with par-

ticular reference to the auto industry) are addressed by examining the regulatory process. It is postulated that managers in the private sector and policymakers in the public sector typically lack specific and well-articulated strategies for dealing with regulatory realities. Managers, it is said, often see regulation narrowly in terms of increased dollar cost and uncertainty failing to recognize the legitimacy. Managerial significance, and competitive implications of regulatory actions. Policymakers have an equally narrow view of regulations as either an administrative or policy problem, failing to recognize the diversity of legitimate competing interests that are created by regulation and expressed in the dynamic process of economics and politics. The lack of attention to issues of institutional capacity and regulatory strategy is seen as related, at least in part, to a generally poor understanding of the complex nature of the regulatory process. The regulatory process is described as interactive, dynamic, and very sensitive to micro-level impacts, characteristics which have important implications for the type of analysis required for effective regulation, the structure of public and private institutions, and the behavior and attitude of individual participants in the regulatory process. It is argued that before they can develop adequate strategies, public and private managers must have better tools of analysis to assess the dynamic characteristics of the regulatory process. All parties in the regulatory process also must distinguish analysis from decision, and must further distinguish decision from strategy. Analysis establishes the terms of trade among society's many conflicting objectives; decision is at least partly an expression of preferences. Policy strategy is a means of marshalling and organizing scarce organizational resources so that over time the cumulative effect of individual decisions will lead to the desired ends.

by Robert A. Leone; John E. Jackson

Harvard Business School; University of Pennsylvania  
 Publ: HS-804 786 (DOT-TSC-NHTSA-79-33), "Workshops on Technological Change in the U.S. Automobile Industry and Symposium on Technology, Government and the Automotive Future, Proceedings," Washington, D.C., 1979 p181-213 1979 ; 7refs

Presented at the Symposium, held in Cambridge, Mass., 20 Oct 1978.

Availability: In HS-804 786

HS-027 367

### INTERNATIONAL COMPETITION IN THE WORLD AUTOMOTIVE INDUSTRY

Following a review of the market changes in the world's auto manufacturing centers, U.S., Western Europe (U.K., Germany, France, Italy), and Japan in the 1960's, the factors influencing international competition in the world automotive industry today are examined. In that decade, market requirements were the main forces determining international competition, but in the 1970's, government policy has emerged as a primary influence. The role and effects are analyzed of the government as legislator in the U.S., as owner in Western Europe, as promoter in Japan, and as initiator in developing countries. Government intervention in various forms is playing an increasing role in the pattern of international competition. Except for the U.S., government intervention tries to aid its domestic motor industry by protecting employment and/or encouraging investment. The U.S. policy is to implement legislation to protect the motorist and conserve energy, which does not necessarily help its auto industry. All the leading automotive producers have increasingly to evaluate the various economic and political factors in their marketing strategies; these decisions are likely to be increasingly directed towards investment rather than trade. Important questions arise as to the continued legislative policy of the U.S. without the need to resort to some form of auto industry pro-

tection, and as to other governments' implementing environmental, safety, and fuel economy measures as in the U.S.

by Michael C. Pearce

Economist Intelligence Unit, Ltd.

Publ: HS-804 786 (DOT-TSC-NHTSA-79-33), "Workshops on Technological Change in the U.S. Automobile Industry and Symposium on Technology, Government and the Automotive Future, Proceedings," Washington, D.C., 1979 p215-33

1979 ; 2refs

Presented at the Symposium, held in Cambridge, Mass., 20 Oct 1978.

Availability: In HS-804 786

HS-027 368

### **AUTOMOBILE EMISSIONS CONTROL POLICY-- SUCCESS STORY OR WRONGHEADED REGULATION?**

The Federal automobile emission control policy is criticized as having undesirable characteristics, and it is argued that a program of effluent fees would eliminate most, if not all, of the unfavorable aspects. It is acknowledged that progress has definitely been made in emissions control technology in the past decade, but that this progress has been slower and more costly than necessary. The gradual phasing in of the emission standards for hydrocarbons, carbon monoxide, and nitrogen oxides had denied the auto industry the learning curve benefits from a long experience with one set of standards. The inflexibility of the standards approach discouraged the introduction of diesels and other alternative engines. Cars in use generally have not been attaining the certification standards; since the standards apply solely to the sale of new cars, car owners have no incentive to maintain their vehicles to achieve low emissions. Currently only a few states and local communities have mandatory inspection and in-use standards programs. The basic logic underlying an effluent fee is that polluters ought to be made to pay the marginal social costs of their polluting activities. By keying fees paid to actual emissions, such a policy allows individuals to take the most efficient actions open to them. If pollution avoidance is expensive, they will choose instead to pay the fee. If the fees are have an incentive to take avoidance actions; if pollution avoidance is expensive, they will choose instead to pay the fee. If the fees are properly structured to represent the marginal social costs of pollution, either choice represents an efficient outcome. Fees would be applied to all motor vehicles in use and on all easily measured harmful pollutants. Fees would be based on short emissions test conducted annually, the amount paid based on mileage driven in the previous year, emissions levels, and particular fee schedules set according to local pollution problems. Individual car owners and automakers would both have incentives for "clean" cars.

by Lawrence J. White

New York Univ.

Publ: HS-804 786 (DOT-TSC-NHTSA-79-33), "Workshops on Technological Change in the U.S. Automobile Industry and Symposium on Technology, Government and the Automotive Future, Proceedings," Washington, D.C., 1979 p235-71

1979 ; 40refs

Presented at the Symposium held in Cambridge, Mass., 20 Oct 1978.

Availability: In HS-804 786

HS-027 369

### **MULTINATIONAL AUTOMOBILE ENTERPRISES AND REGULATION: AN HISTORICAL OVERVIEW**

The history of multinational automobile enterprises (U.S., European, and Japanese automakers) and the influence of government regulation is traced for the pre-World II period, the Inter-War years, 1945-1970, and recent times (1968-1978). Government regulations of various sorts have had, and will continue in the future to have, an important influence on the industry in the U.S. and abroad. What is distinctive today seems to be the new and imposing impact of the particular regulatory measures concerned with safety, pollution, and especially energy, on a thoroughly multinational industry. The specter of varying forms of trade restraint seems present; these restraints are bound to create distortions in international markets. All these national regulatory actions can have unanticipated consequences, unless policymakers view them in the context of multinational automobile enterprises operating through investment and licensing as well as trade in an increasingly intergrated worldwide auto industry.

by Mira Wilkins

Florida International Univ., Dept. of Economics

Publ: HS-804 786 (DOT-TSC-NHTSA-79-33), "Workshops on Technological Change in the U.S. Automobile Industry and Symposium on Technology, Government and the Automotive Future, Proceedings," Washington, D.C., 1979 p273-326

1979 ; refs

Presented at the Symposium held in Cambridge, Mass., 20 Oct 1978.

Availability: In HS-804 786

HS-027 370

### **STATUS OF THE AUTOMOTIVE SUPPLY INDUSTRY: A REVIEW OF INDUSTRY TRENDS FROM THE TRADE LITERATURE**

Through a review of the trade literature, the present situation of the U.S. automotive supply industry is analyzed in view of the changing needs of the automakers in meeting Federal emission, fuel economy, and safety standards. The problems facing the auto suppliers include uncertainty in the auto market, squeeze on profits, emphasis on primary materials and electronics technology, ambiguity of Federal regulations, and influx of foreign auto suppliers. The response of auto suppliers to these problems is discussed in terms of marketing strategy, capital investment decisions, management organization and research and development strategy. The role of the auto suppliers, automakers, and Federal government in increasing the auto supplier's contribution to technological innovation in the automotive industry is addressed. The auto suppliers will need the ability to understand and work with government, to understand and respond to changing industry economics, and to correctly perceive the consequences of government regulation. They will also need to improve their interface with other suppliers and the auto companies. The automakers may also be able to improve their working relationship with the auto suppliers. It is incumbent upon the auto companies to reduce wherever possible the high risks and costs of the automotive original equipment market. The areas deserving government attention include product liability, international trade, antitrust activity, inconsistent regulations and enforcement, and incentives for innovation.



HS-803 443

by Edward C. Dempsey  
Harvard Business School  
Publ: HS-804 786 (DOT-TSC-NHTSA-79-33), "Workshops on Technological Change in the U.S. Automobile Industry and Symposium on Technology, Government and the Automotive Future, Proceedings," Washington, D.C., 1979 pD-1--D-36 1979 ; 100refs  
Availability: In HS-804 786

HS-803 443

**CRASH VICTIM EXTRICATION TRAINING COURSE. EMERGENCY MEDICAL TECHNICIAN. STUDENT'S MANUAL. REV. ED.**

This student manual is the primary text (study materials and later reference source) for a training course for emergency medical technicians (EMT'S) which addresses the problems of light rescue, specifically those involved in extricating people from automobiles and buses. Although designed basically for EMT'S, this course also meets the requirements for teaching light-duty extrication methods to rescue and safety personnel who have completed the National Hwy. Traffic Safety Administration (NHTSA) First Responder Training Course. Specific objectives of the course are to teach EMT'S their role and responsibilities in extrication; to develop their skill in analyzing the accident situation, stabilizing, gaining access, instituting life-saving emergency medical care techniques, disentangling, and removing the injured victim from the wreckage; to develop their skill in the use and care of extrication and related tools and equipment; and to develop their awareness of the hazards which may be encountered at the accident scene. The course comprises five lessons involving 16 hours of instruction, and testing, and is designed to be taught in a two-day period. Desirable qualifications for EMT'S who attend the Crash Victim Extrication Course are: satisfactory completion of the NHTSA Basic Training Course for EMT--\*AMBULANCE or equivalent, or the NHTSA First Responder Training Course; a desire to expand basic extrication knowledge; ability to work as a team member, and to analyze a situation accurately, and take or suggest an effective course of action; and meet state qualification standards.

National Hwy. Traffic Safety Administration, Emergency Medical Services Branch, 400 7th St., S.W., Washington, D.C. 20590  
1979 ; 37p 2refs  
Clearinghouse Training Materials. Subject: Escape and Removal of Injured. Format: Student Manual. See also HS-803 444. Type of Audience: Emergency Medical Technicians.  
Availability: GPO, stock no. 050-003-00344-1

HS-803 444

**CRASH VICTIM EXTRICATION TRAINING COURSE. EMERGENCY MEDICAL TECHNICIAN. INSTRUCTOR'S MANUAL. REV. ED.**

This instructor manual is to assist course coordinators and other individuals in organizing and implementing a course of study which addresses the problems of light rescue (i.e. extricating accident victims from automobiles and buses) by emergency medical technicians (EMT'S). The manual contains an outline of the course, instructor and student qualifications, classroom and demonstration equipment requirements, guidelines for conducting the course, and recommendations for student evaluation. Although designed basically for EMT'S, this course also meets the requirements for teaching light-duty extrication methods to rescue and safety personnel who have completed the National

HSL 80-0

Hwy. Traffic Safety Administration First Responder Training Course. Specific objectives of the course are to teach EMT'S their role and responsibilities in extrication; to develop their skill in analyzing the accident situation, stabilizing, gaining access, instituting life-saving emergency medical care techniques, disentangling, and removing the injured victim from the wreckage; to develop their skill in the use and care of extrication and related tools and equipment; and to develop their awareness of the hazards which may be encountered at the accident scene. The course comprises five lessons involving 16 hours of instruction, demonstration, individual participation, and testing, and is designed to be taught in a two-day period. Recommended class size is 24 students, with at least one instructor aid for each eight students during practice and demonstration periods. The lead instructor and instructor aides should be certified EMT'S, thoroughly knowledgeable in the information and skills for the particular lesson period. Personnel from fire, rescue and ambulance services with extensive experience in extrication procedures should be utilized. Each lesson plan contains performance objectives, references, equipment and materials, content outline, demonstration outlines, practice sessions, and skill evaluations components. It is recommended that each student be evaluated on skill proficiency at the completion of each lesson (skill evaluation sheets provided); pop quizzes at the end of each lesson and a final written exam on knowledge objectives are also recommended.

National Hwy. Traffic Safety Administration, Emergency Medical Services Branch, 400 7th St., S.W., Washington, D.C. 20590  
1979 ; 46p 13refs  
Clearinghouse Training Materials. Subject: Escape and Removal of Injured. Format: Instructor Manual. See also HS-803 443. Type of Audience: Emergency Medical Technicians.  
Availability: GPO, stock no. 050-003-00343-3

HS-803 656

**STOCHASTIC ANALYSIS OF FUTURE VEHICLE POPULATIONS. FINAL REPORT**

Purpose of this study was to build a stochastic model of future vehicle populations, useable in investigating the uncertainties inherent in Future Vehicle Populations. The model, called the Future Automobile Population Stochastic Model (FAPS Model), consists of two major components: a model of new car sales, the model of automobile demand developed by Wharton Econometric Forecasting Associates, revised to incorporate the new vehicle survival model that was developed; and a procedure for specifying future planned and unplanned events, which specifies the future values of exogenous parameters of the model and incorporates the uncertainty of these parameters into the model. A computer program of the FAPS/MODEL was written and is documented in the report. Also appended are a survey of earlier and recent models, with bibliography, notes on the Weibull distribution, and a brief discussion of the innovations in the FAPS model.

by D. Henry Golomb; Howard M. Bunch  
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor, Mich. 48109  
DOT-TS-13729  
Rept. No. UM-HSRI-78-15; DOT-TSC-NHTSA-79-20 ; 1979 ; 109p 39refs  
Rept. 19 Apr 1977-15 Apr 1978.  
Availability: NTIS

HS-803 842

# **ANALYSES OF SELECTED AUTOMOTIVE PARTS AND ASSEMBLIES FOR COST AND MATERIAL IMPACTS. FINAL REPORT**

Manufacturing cost data, including all of the elements of cost (fixed, variable, tooling), as well as production processing information is presented for a wide variety of automotive components and assemblies. A representative vehicle, a 1975 Chevelle, was disassembled and analyzed on a part-by-part basis. The various cost elements which comprise total manufacturing cost were calculated, applicable processing methods determined, material analyses completed, and other pertinent information compiled. The process, cost, and material information is presented in various formats. All information reflects the current automotive production methodology. Comparisons of costs and materials of engine and transmission parts are provided for the 1975 Ford Pinto, 1975 Chevelle, 1976 Audi 100LS, and 1976 VW Rabbit. A review is included of generally accepted cost analysis techniques used by automotive companies to develop comparative, or target, costs. The various methods are discussed, including those using the cost data bank information, detailed manufacturing process cost techniques, and sign variance. Process descriptions of the selected vehicle and engine/transmission parts include the number of process operations, material, grade of material, rough and finished part weights, cost of raw material, variable cost, and other cost elements. Groupings by physical characteristics, material, and manufacturing processes are used to study the cost effects for various types of similar parts from different vehicles. Other studies are included to illustrate the cost impacts of alternate materials on various components.

by Robert W. Reinhardt  
Pioneer Engineering and Mfg. Co., 2500 E. Nine Mile Rd.,  
Warren, Mich. 48091  
DOT-TSC-1045-\*MOD-3  
Rept. No. DOT-TSC-NHTSA-79-19 ; 1979 ; 463p  
Rept. for Mar 1977-Aug 1978.  
Availability: NTIS

HS-803 855

# **STUDY AND TEST TO CONFIRM AUTOMOBILE DRIVETRAIN COMPONENTS TO IMPROVE FUEL ECONOMY. VOL. 1, HISTORY OF THE AUTOMOBILE TRANSMISSION IN THE UNITED STATES. INTERIM REPORT**

An interim report presents a study of U.S. automatic transmissions, exploring the design from the earliest manual sliding gear transmission up through the various forms of automotive gear boxes, with emphasis on the development of the automatic transmission. It contains, in tabular form, a description of the 1970-1975 engine/transmission/rear axle ratio/vehicle size and weight combinations available in all U.S. cars of this time period. Included are early developments, the evolution of the self-shift, development during the 1920's and new techniques in the late '20s and '30s, evolution, elements and family tree of the modern automatic transmission, with numerous diagrams.

by D. A. Hurter; P. G. Gott; C. A. Gottesman  
Arthur D. Little, Inc., Acorn Park, Cambridge, Mass. 02140  
DOT/TSC-1046  
Rept. No. DOT-TSC-NHTSA-79-11.\*1 ; 1979 ; 132p  
Rept. for Jun 1975-Dec 1976. Vol. 2, The Drivetrain Design Process With An Automatic Transmission, is HS-803 856.  
Availability: NTIS

HS-803 891

# **JUVENILE COURT ALCOHOL SCHOOL EVALUATION. INTERIM REPORT, SEPTEMBER 29, 1976 TO JUNE 1, 1977**

Following an overview of project background and operation, results are presented of an evaluation of the Utah Juvenile Court Alcohol School, based on an analysis of 30% of the data after six months of operation. The School, begun in 1976, is an educational program attended by random juveniles convicted of alcohol offenses, and their parents. The School consists of five-weekly, two-hour educational sessions; the changes in the school participants are measured by pre-, post-, and six-month follow-up questionnaires and record checks. For evaluation purposes, three juvenile/parent groups have been established in addition to the School Group; they are the Contact Group (use of five one-hour sessions), the Regular Group (court alternatives applied), and the Cohort Group (general juvenile population comparison group). Findings are presented for three treatment groups (and comparison group, where applicable) based on questionnaire responses which have been grouped under the following categories: background demographics, cohort demographics, criminal history, driving history, teen driver responses, treatment motivation, self-perception, family life perception, parental support of juveniles, juvenile perception of parental support, parental support of juvenile decision making, juvenile control, parent control, communications, socialability level with peer relationships, alcohol knowledge, attitude toward use of alcohol. The interim evaluation revealed that data categories which showed no pre-post difference were about equal to those with interesting and statistically significant differences. Appendixes contain pre-, post-, and follow-up questionnaires for the Juvenile Alcohol School, and questionnaire response evaluation approach; evaluation file design for the Statistical Package for the Social Sciences, data keying format, data control procedures, and data collection coding forms; and the Juvenile Alcohol School Facilitator Manual.

by Stephen W. Glines; Roy N. Byrd  
Utah Hwy. Safety Office, 455 E. 4th South, Suite 314, Salt Lake City, Utah 84111  
DOT-HS-6-01487  
Rept. No. DOT-HS-6-01487-(\*I-1) ; 1977 ; 168p refs  
Cover date is Mar 1979.  
Availability: NTIS

HS-803 894

# **DEVELOPMENT OF A MOTOR VEHICLE MATERIALS HISTORICAL HIGH-VOLUME INDUSTRIAL PROCESSING RATES COST DATA BANK [FOR THE] (3500-4000 POUND) FULL SIZE CAR. FINAL REPORT**

Efforts toward identifying and establishing a Motor Vehicle Materials High-Volume Industrial Processing Cost Data Bank for the 3500-4000 pound Full-Size Car were a macro- and micro-analysis, in which various costs were generated using an industry type estimating technique. In the micro-analysis method, a 1978 full-size production vehicle (Chevrolet Impala) was obtained and dismantled, and its various components and subassemblies analyzed in detail to determine the weight and estimated manufacturing cost associated with each item. From this basic data, other categorical costs were estimated, both in total for each item and on a cost per pound basis. The various items were grouped into several levels of assemblies on a basis of practiced industry groupings to arrive at total cost categories for a complete vehicle. The macro-analysis served as a means to

HS-803 895

provide data in certain areas to substantiate the microanalysis, involving the determination of various average costs by a study of the past five years of historical financial records of the automotive corporation. Appendices include the micro-analysis cost data, the macro-analysis of General Motors records, and photographs of components for use in future cost study comparisons. Additional studies are recommended on other market classes defined by weight and cost.

Pioneer Engineering and Mfg. Co., 2500 East Nine Mile Rd.,  
Warren, Mich. 48091  
DOT-HS-7-01769  
1978 ; 330p  
Availability: NTIS

HS-803 895

#### **STANDARDS ENFORCEMENT TEST REPORTS INDEX FOR 1978**

The tenth in a series of indexes is provided to Compliance Test Reports of the National Hwy. Traffic Safety Administration (NHTSA) released to the public during calendar year 1978. The index is divided into 11 sections: manufacturer, model year, model or part number, failures, Federal Motor Vehicle Safety Standard number, component or vehicle identification (NHTSA number), laboratory test number, CIR number, HS number, brand or seller, and tire size or body style.

Kappa Systems, Inc., 1501 Wilson Blvd., Arlington, Va. 22209  
NHTSA-P.O.-8-0407  
1979 ; 1572p  
Availability: NTIS

HS-803 960

#### **IMPACTS OF MOTORCYCLE HELMET LAW REPEAL IN SOUTH DAKOTA: EXECUTIVE SUMMARY. FINAL REPORT.**

Changes in levels of helmet use and in types of injury sustained by motorcycle accident victims between pre- and post-repeal periods of the South Dakota mandatory helmet law are described. Statewide surveys of helmet use in 1976 (pre-repeal) and in 1977 (post-repeal) involved the observance of 25,054 cyclists. Overall levels of helmet use were found to have dropped from 99.6% in 1976 to 57.3% in 1977 for cycle drivers, with a decline from 99.3% to 60.7% for passengers. Decreases in helmet use were large and significant for all times of day, days of week, and roadway types. Analysis of medical records data for motorcycle accident victims showed statistically significant increases in the incidence of head/skull injuries between pre- and post-repeal periods and between helmeted and unhelmeted drivers. Recorded levels of injury severity were significantly higher for unhelmeted drivers in both periods. Despite significant changes in incidence of head injuries, the statewide fatal, injury, and total crash rates were not substantially different between pre- and post-repeal periods.

by V. S. Ellingstad  
University of South Dakota, Human Factors Lab., Vermillion,  
S. Dak. 57069  
DOT-HS-6-01423  
Rept. No. HFL-78-8 ; 1979 ; 35p  
Rept. for Jul 1976-Nov 1978.  
Availability: NTIS

HSL 80

HS-803 974

#### **ANALYZING THE FEASIBILITY OF THE ADMINISTRATIVE ADJUDICATION OF TRAFFIC OFFENSES. VOL. 2. FINAL REPORT**

Information is provided to aid analysts in assessing the costs and benefits of the administrative adjudication of traffic offenses at state and local jurisdictions. Issues are discussed related to organization, management, and presentation of findings of a feasibility study. Checklists of the types of benefits and costs that should be considered are presented, with data and examples to aid in making quantitative estimates. Issues that normally would be addressed in a benefit-cost analysis of alternative adjudicative systems for traffic offenses include basic arguments for administrative adjudication, legal and constitutional issues, participation of special interest group concerns, the monetary and nonmonetary treatment of benefits and costs, and the treatment of traffic safety issues. Appendices contain additional material on the technical aspects of a benefit-cost analysis of administrative adjudication, formats for the illustration and presentation of findings, and other supporting information.

by Anthony K. Mason; Thomas J. Novi  
Anthony K. Mason, P.E., 6209 Avenida Cresta, LaJolla, Calif. 92037  
NHTSA-P.O.-7-3161  
1978 ; 110p refs  
Vol. 1 is HS-803 973.  
Availability: NTIS

HS-803 990

#### **DEVELOPMENT OF COMPLIANCE TEST FOR TRUCK REAR UNDERRIDE PROTECTION. TASK REPORT OF TESTS 5.1, 5.2, AND 5.3. INTERIM REPORT**

Results are presented for the first three of eight vehicle-to-truck rear underride guard crash tests designed to test the effectiveness of selected new guard designs in rear underride collisions with current production full- and small-size passenger cars. The tests are to provide a basis for selecting the best underride guard with regard to such critical parameters as geometric design, strength, energy-absorbing capabilities, and economic and environmental factors. The test vehicles (1978 VW Rabbits and 1978 Ford Fiesta) were impacted (about 40 mph) into bolted, rigid, cantilevered guards mounted to a truck/trailer body simulator (a modified 1977 Fruehauf 40-ft, heavy-duty platform trailer with Select-A-Point tandem rear wheels). For the three systematic tests, two instrumented 50th percentile Part 572 anthropomorphic dummies were placed in the driver and front passenger positions in the car, and were restrained with the vehicle restraint system. The seat tracks were welded in the midposition to prevent breakaway and/or rotation.

by R. Baczynski; S. Davis; R. Cropper  
Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix, Ariz. 85027  
DOT-HS-8-01905  
Rept. No. 8319-78-193A ; 1978 ; 160p  
Rept. for Oct-Nov 1978. See also HS-803 991 and HS-803 992.  
Availability: NTIS

HS-803 991

# **DEVELOPMENT OF COMPLIANCE TEST FOR TRUCK REAR UNDERRIDE PROTECTION. TASK 4 TEST REPORT. INTERIM REPORT**

Results are presented for six vehicle-to-truck rear underride guard crash tests (four symmetric and two offset) designed to establish baseline parameters under present conditions with current production full- and small-size passenger cars. The test vehicles (1978 VW Rabbit and 1978 Chevrolet Impala four-door sedans) were impacted (about 30 mph and about 40 mph) into a bolt-on underride guard (Fruehauf Part No. FCE-1456-1) mounted to a truck/trailer body simulator (a modified 1977 Fruehauf 40-ft, heavy-duty platform trailer with Select-A-Point tandem rear wheels). For the six tests, two instrumented 50th percentile Part 572 anthropomorphic dummies were placed in the driver and front passenger positions in the car, and were restrained with the vehicle's restraint system. The seat tracks were welded in midposition to prevent breakaway and/or rotation.

by R. Baczynski; S. Davis  
Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix, Ariz. 85027  
DOT-HS-8-01905  
Rept. No. 8319-78-149A ; 1978 ; 260p  
Rept. for Jun-Sept 1978. See also HS-803 990 and HS-803 992.  
Availability: NTIS

HS-803 992

# **DEVELOPMENT OF COMPLIANCE TEST FOR TRUCK REAR UNDERRIDE PROTECTION. TASK 3 TEST REPORT, INTERIM REPORT**

Results are presented for two vehicle-to-truck rear underride guard crash tests (one symmetric and one offset) designed to provide data for establishing criteria for future tests in a program for the compliance testing of rear underride guards. The tests approximately model the rear of chosen truck trailer bodies to the extent of providing repeatable and indicative dynamic test results. The test vehicles (1966 full-size Ford Galaxy four-door sedans) were impacted (about 40 mph) into a bolt-on underride guard (Fruehauf Part No. FCE-1456-1) mounted to a truck/trailer body simulator (a modified 1977 Fruehauf 40-ft, heavy-duty platform trailer with Select-a-Point tandem rear wheels). For the two tests, one uninstrumented 50th percentile VIP anthropomorphic dummy was placed in the driver position in the car, and was restrained with the vehicle's restraint system. The seat tracks were welded in the midposition to prevent breakaway and/or rotation.

by R. Baczynski; S. Davis  
Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix, Ariz. 85027  
DOT-HS-8-01905  
Rept. No. 8319-78-139A ; 1978 ; 86p  
Rept. for Jun-Aug 1978. See also HS-803 990 and HS-803 991.  
Availability: NTIS

HS-803 996

# **IMPACTS OF MOTORCYCLE HELMET LAW REPEAL IN SOUTH DAKOTA. VOL. 1. FINAL REPORT**

The S. Dak. statute mandating helmet use by motorcyclists was modified, effective 1 Jul 1977, to effectively repeal the law for adult cyclists. Changes in levels of helmet use and in state-wide

accident experience are assessed between pre- and post-repeal periods. State-wide surveys of helmet use involving observations of 12,228 cyclists in 1976 and 12,826 in 1977 showed statistically significant declines in rates of helmet use for all sub-sets of cyclists. The overall rate of driver helmet use declined from 99.6% in the pre-repeal period to 57.3% during the post-repeal period. Passenger helmet use declined from 99.3% to 60.7% between periods. Large decreases in helmet use were observed for all time-of-day and day-of-week periods, and for all roadway types. Although no detectable changes were observed in state-wide fatal, injury, or total crash rates, analyses of medical data for accident victims showed substantial evidence of negative impact of helmet law repeal. During the 24-month study period, head/skull injuries were recorded for 9.2% of helmeted riders compared to 21.1% of unhelmeted riders. Injury severity was also significantly greater for unhelmeted than for helmeted accident victims.

by Cynthia Struckman-Johnson; Vernon S. Ellingstad  
University of South Dakota, Human Factors Lab., Vermillion, S. Dak. 57069  
DOT-HS-6-01423  
Rept. No. HFL-78-7 ; 1979 ; 106p  
Rept. for Jul 1976-Nov 1978. HS-803 997 contains appendices.  
Availability: NTIS

HS-803 997

# **IMPACTS OF MOTORCYCLE HELMET LAW REPEAL IN SOUTH DAKOTA. APPENDICES. FINAL REPORT**

Materials and data supplementary to Vol. 1 of the study on impacts of motorcycle helmet law repeal in S. Dak. are presented in 14 appendices. These include a description of sites and area maps for the sampling locations, S. Dak. police reports and a medical injury data report form, copies of letters requesting hospital participation and victims' consent forms, raw frequencies for the accident file, driver-vehicle file and rider file variables, and extensive supplementary tables.

by Cynthia Struckman-Johnson; Vernon S. Ellingstad  
University of South Dakota, Human Factors Lab., Vermillion, S. Dak. 57069  
DOT-HS-6-01423  
Rept. No. HFL-78-7-\*APP. ; 1978 ; 174p  
Rept. for Jul 1976-Nov 1978. Vol. 1 is HS-803 996.  
Availability: NTIS

HS-804 010

# **AN INITIAL ASSESSMENT OF THE LITERATURE ON THE MEASUREMENT, CONTROL TRANSPORT, TRANSFORMATION AND HEALTH EFFECTS OF UNREGULATED DIESEL ENGINE EMISSIONS. FINAL REPORT**

An initial assessment is presented of the literature in critical areas related to the measurement, control, atmospheric processes, and possible health effects of unregulated diesel engine emissions, under four major topics: measurement and characterization of emissions; control technology; atmospheric transport, transformation and microbiological assay; and carcinogenic aspects. Primary emphasis is directed at particulate matter, with secondary emphasis on odor and gaseous phase organics. A separate bibliography follows each section.

HS-804 018

by Jerar Andon; Harold M. Siegel; John H. Johnson; David G. Leddy Cauwenberghe; Ivar Tombach; Thomas H. Milby; Donald V. Lassiter  
South Coast Technology, Inc., P.O. Box 3265, Santa Barbara, Calif. 93105; Michigan Technological Univ.; University of California, Statewide Air Pollution Res. Center; AeroVironment, Inc.; Environmental Health Associates, Inc.  
DOT-HS-7-01790  
1979 ; 515p refs  
Rept. for Mar 1978-Jan 1979.  
Availability: NTIS

HS-804 018

### **IMPACT OF THE REPEAL OF THE KANSAS MANDATORY MOTORCYCLE HELMET LAW. FINAL REPORT**

An evaluation was made of the effects of the repeal of the Kansas mandatory motorcycle helmet law (effective 1 Jul 1976), through a retrospective analysis of the incidence and severity of injuries to motor cyclists involved in accidents in pre- and post-repeal periods. In addition to collecting data on accidents and injuries occurring in 1975 and 1976, an observational survey was completed during 1977 to determine current usage of motorcycle helmets and/or eye protection. The overall usage of motorcycle was found to be 47.1%. while some form of eye protection was used by 70.2% of those observed. The data indicate that statistically significant increases in the incidence and severity of injuries to the head and to the general body occurred between the pre-repeal and post-repeal periods. Extremely significant increases were found for nonhelmeted vs. helmeted riders. The data also indicate that the crude death rate was significantly higher for nonhelmeted vs. helmeted motorcyclists.

by Michael L. Lummis; Glenn J. Tucker  
University of Kansas Coll. of Health Sciences, Emergency Medical Training Prog., 39th at Rainbow Blvd., Kansas City, Kans. 66103  
DOT-HS-7-01563  
1979 ; 172p 3refs  
Rept. for Jul-Sep 1975 and Jul-Sep 1976  
Availability: NTIS

HS-804 025

### **SCHOOL BUS OCCUPANT RETROFIT PROTECTIVE MATERIALS. VOL. 1: FINAL SUMMARY REPORT**

by R. M. Zimmerman  
New Mexico State Univ., Physical Science lab., Box 3-PSL NMSU, Las Cruces, N. Mex. 88003  
DOT-HS-7-01572  
1978 ; 34p  
Rept. for 11 Feb-1 Apr 1978. For abstract, see HS-804 026.  
Cover date is Apr 1979.  
Availability: NTIS

HS-804 026

### **SCHOOL BUS OCCUPANT RETROFIT PROTECTIVE MATERIALS. VOL. 2: FINAL TECHNICAL REPORT.**

An investigation was made of the methods and materials that might be used to retrofit protective padding to older model school bus seats, modesty panels, and stanchions. Laboratory tests were designed to compare these bus components with and

HSL 80-01

without protective padding. The tests were conducted under Federal Motor Vehicle Safety Standard (FMVSS) 222, School Bus Seating and Crash Protection, guidelines in an attempt to evaluate applicability to retrofitting. Impact tests were conducted on existing commercial retrofit padding and on candidate materials. It was determined that the dynamic portions of FMVSS 222 could be applied to the retrofitting of older model school buses. The seat back rail and the modesty panel were found to be the most dangerous objects in terms of potential facial injuries. It was found that the older model school bus seats do not present severe danger of concussion-type head injuries as defined by the Head Injury Criterion value of FMVSS 222. It is concluded that existing commercial padding could be used to minimize facial-type injuries in accordance with FMVSS 222.

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New Mexico State Univ., Physical Science Lab., Box 3-PSL NMSU, Las Cruces, N. Mex. 88003  
DOT-HS-7-01572  
1978 ; 121p 2refs  
Rept. for 11 Feb-1 Apr 1978. For summary report, see HS-804 025. Cover date is Apr 1979  
Availability: ntis

HS-804 031

### **PROPOSED PLAN FOR HIGHWAY SAFETY RESEARCH, DEVELOPMENT AND DEMONSTRATION (SECTION 403 OF TITLE 23, USC) FISCAL YEARS 1980-1984**

The Section 403 (of the Highway Safety Act of 1966) program priorities are described, along with supporting rationale, for fiscal years 1980 through 1984. Specific projects and associated funding are presented by year, as well as the program areas. Project area descriptions and resultant products are included. The proposed plan provides the U.S. highway safety community and general public with an opportunity to react and comment during the early stages of the 403 program planning process. The National Hwy. Traffic Safety Administration (NHTSA) is also seeking the expertise of the safety community by sponsoring a 403 Program Conference at the Dulles Marriott Hotel, Chantilly, Virginia, Apr 22-26, 1979, to be conducted by the Transportation Research Board (TRB) of the National Academy of Sciences. That organization will act as an independent and objective moderator for reactions to the 403 Program Plan, and will formally report the Conference results to NHTSA, the safety community, and the public by Aug 1979. The intention is to provide a neutral atmosphere for the integration of private, public, and government opinion for the purposes of molding a 403 highway safety plan which is responsive to state and community needs. The TRB Conference Report will assist NHTSA in its Section 403 planning, and along with comments to the docket, will form the basis for publication of an updated Section 403 plan in late 1979.

National Hwy. Traffic Safety Administration, 400 7th St., S.W., Washington, D.C. 20590  
1979 ; 131p  
Availability: Corporate author

HS-804 093

### **DEVELOPMENT OF VEHICLE ROLLOVER MANEUVER. VOL. 1. FINAL REPORT**

Results are reported of research aimed at investigating the rollover response characteristics of automobiles. Emphasis was

placed on the development of a test procedure to evaluate performance under untripped flat-surface operating conditions. Both simulation and full-scale experimental methods were employed to examine the effects of a variety of configurational and operational factors on rollover response. Over 500 test runs involving seven vehicles in ten configurations were performed. Studies were made of the effect of initial speed, steering input patterns, braking techniques, suspension damping, loading, and tire characteristics. Testing was performed using both manual and automatic control methods. Appended are a review of the literature concerning rollover in actual accidents, analyses of the physics of tripped and flat surface (untripped) rollover, a discussion of the simulation study results, and an outline of a preliminary test procedure for vehicle rollover resistance evaluation. It was concluded that vehicle rollover response is dominated by the vehicle's rigid body geometry (with dynamic contributions from suspension effects) and that untripped rollover, even on highly skid-resistant surfaces, is difficult to predict and accomplish.

by Roy S. Rice; David J. Segal; Ian S. Jones  
Calspan Corp., Advanced Technology Center, P.O. Box 400,  
Buffalo, N.Y. 14225  
DOT-HS-6-01382  
Rept. No. ZQ-5993-\*V-1 ; 1978 ; 231p 32refs  
Rept. for 30 Jun 1976-30 Jun 1978. Vol. 2 Executive Summary,  
is HS-804 094.  
Availability: NTIS

HS-804 095

# **SIGNAL LIGHTING SYSTEM REQUIREMENTS FOR EMERGENCY, SCHOOL BUS AND SERVICE VEHICLES. FINAL REPORT**

The inconsistency between various state laws and the Uniform Vehicle Code is reviewed regarding lighting systems for special vehicles and school buses. Accident data are cited that may have pertinent implications to the problem of lighting system design for these vehicles. Driver behavior problems are discussed that may be associated with the ambiguity of current signal messages, and an analysis is presented of the signal messages necessary to conduct particular vehicular missions. The review indicates that there is a diverse array of lighting devices available. Psychophysical visual and applied research was reviewed for information on the advantages and disadvantages of various coding parameters. An analysis of color, intensity, and flash rate summarized the information available that is applicable to special vehicle signaling systems. From this information was developed a set of recommended signals to transmit the messages deemed necessary for the efficient and safe control of various vehicular missions. These recommendations took into account current legal, stereotype, and changeover constraints. School bus signaling procedures were also reviewed and specific recommendations are made for new signals, usage procedures, legal language, and research.

by David V. Post; Michael Sivak  
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,  
Mich. 48109  
DOT-HS-6-01468  
Rept. No. UM-HSRI-78-55 ; 1978 ; 163p refs  
Rept. for 14 Sep 1976-15 Nov 1978.  
Availability: NTIS

HS-804 151

# **THE UNITED KINGDOM AUTOMOBILE INSURANCE MARKET. FINAL REPORT**

A limited study is presented of the United Kingdom automobile insurance industry, under six major topics: structure and size of the industry (proprietary and mutual insurance companies, and Lloyds Underwriters); the basis of premium calculation, rate structure, types of policies, and payment of compensation; marketing of insurance; the role of the (British) Automobile Assoc. and the Royal Automobile Club; differences between individual and fleet insurance policies; and the profitability of the British insurance system. Appended are lists of members of the British Insurance Assoc. and of Lloyds Motor Underwriters Assoc.

Economist Intelligence Unit, Ltd., Spenser House, 27 St. James Place, London, SW1A 1NT, England  
DOT-TS-15109  
Rept. No. DOT-TSC-NHTSA-79-23 ; 1979 ; 40p  
Rept. for Feb-May 1978.  
Availability: NTIS

HS-804 186

# **FIVE YEAR PLAN FOR MOTOR VEHICLE SAFETY AND FUEL ECONOMY RULEMAKING, CALENDAR YEARS 1980-1984**

The National Hwy. Traffic Safety Administration's (NHTSA) five year plan for motor vehicle safety and fuel economy updated from that of 16 Mar 1978 (43 F.R. 11100), is designed to provide policy guidance for use within NHTSA for the development and issuance of standards, to provide the public with information on proposed future activities and priorities, and to permit the motor vehicle industry to incorporate potential requirements in its long-range planning. The tentative rule-making goals and priorities are briefly described and summarized, and public comments analyzed. Accomplishments since the draft publication are identified, as well as those areas where significant rulemaking is not expected to take place. A rulemaking schedule shows the anticipated dates for issuance of proposals and final rules and a rough estimate of the anticipated effective dates. Also included are those pending rulemaking actions which NHTSA contemplates terminating. Cross-referenced indexes cover changes since the Mar 1978 rulemaking plan, proposed safety rulemaking by vehicle type, and rulemaking by proposed effective date. An appendix describes in more detail the individual motor vehicle safety rulemaking actions, including a discussion of the safety problem that a regulation is designed to ameliorate, the approach to be used in developing and issuing the rule, and some of the major issues to be resolved in the development of the final rule.

National Hwy. Traffic Safety Administration, 400 7th St., S.W.  
Washington, D.C. 20590  
1979 ; 66p refs  
Availability: Corporate author

HS-804 189

# **RSV [RESEARCH SAFETY VEHICLE] PHASE 3. PROGRESS REPORT NO. 12, DECEMBER 1978-JANUARY 1979**

Progress made on the Minicars RSV (Research Safety Vehicle) Phase 3 program is reported in task sections, summarized to the subtask level. Tasks include program management, product improvement of inflatable restraints, structural refinement, systems

refinement, plastic material improvement, electronic system, ride and handling, pedestrian impact, compatibility analysis, high-technology engine/transmission, structures and systems fabrication, accident/benefit analysis, and advanced engine. Tasks involving the Large Research Safety Vehicle (LRSV) include structure, restraints, design integration, testing, technology transfer support, and demonstration vehicle. Glazing, production planning, tooling, and pilot production are also reported. Appended are data traces for driver and passenger restraint system sled tests, for pulse development sled runs, and for 50 mph frontal impact test of RSV with a flat barrier. Also appended are subcontractor reports from RCA Labs. (electronics), Dubner Computer Systems, Inc. (analysis of high-technology transmission data), and Kinetic Res., Inc. (analysis of National Crash Severity data, comparison of vehicle population data used in the Kinetic Res. Accident Environment Simulation and Projection model with similar data projected by the Wharton Motor Vehicle Demand model).

Minicars, Inc., 55 Depot Rd., Goleta, Calif. 93017  
DOT-HS-7-01552  
Rept. No. BPR-2100-01-79 ; 1979 ; 245p  
Availability: Reference copy only

HS-804 718

#### FINAL ASSESSMENT OF THE BUMPER STANDARD

After examination of all available information from public comment, special orders to manufacturers, and crash tests, the costs and benefits were assessed of bumper technology used to comply with the Part 581 Bumper Standard issued in 1975. The analysis was made in three steps: various bumper systems and design speeds were defined; the costs and benefits were derived that accrue with each of ten bumper systems at each design speed decision; and totalled costs and benefits provided the net benefit for each bumper system at each design speed. Among the bumper systems considered are the unregulated (baseline) system, and steel, aluminum, and soft face bumpers (Phase I). A discussion of Phase II bumpers is appended. The first phase of the standard, effective 1 Sep 1978, requires that the vehicle, other than the bumper system, not be damaged in 5.0 mph front and rear barrier and pendulum impacts and 3 mph corner pendulum impacts. The second phase, effective 1 Sep 1979, limits the damage to the bumper itself. Included in the analysis are factors of obtainable costs and benefits, effect on insurance and legal fees, savings of consumer time and inconvenience, and considerations of health and safety. Further research is investigating reduction of injury to pedestrians by new urethane bumpers and front ends.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590  
1979 ; 205p 24refs  
Executive Summary is HS-804 719.  
Availability: NHTSA

HS-804 719

#### FINAL ASSESSMENT OF THE BUMPER STANDARD. EXECUTIVE SUMMARY

A revised analysis is summarized of the comparative cost savings for car owners from the Federal 5.0 mph bumper standard and alternative 2.5 mph and 7.5 mph standards. A number of changes in the analysis and data from the initial 26 Feb 1979 report are summarized, focusing on steel bumpers; topics discussed are vehicle miles traveled/1978 dollars, prestandard

damage/effectiveness of improved bumpers, bumper replacement costs, and insurance adjustment. The final assessment shows that 5.0 mph bumpers provide greater savings to the consumer than 2.5 mph bumpers. The Feb analysis showed that the net lifetime benefits of 2.5 mph bumpers were approximately \$77 greater than the net benefits of 5.0 mph bumpers, sales weighted by bumper type (steel, aluminum, soft face). The revised analysis shows that the 5.0 mph bumpers produce approximately \$39 more in net benefits than the 2.5 mph bumpers. The net benefit is the present value of the expected savings resulting principally from damage avoided as a result of improved bumpers less the cost increases associated with the purchase and use of improved bumpers. The revised analysis also indicates that 7.5 mph bumpers produce marginally greater savings than 5.0 mph bumpers, although these results are far less reliable because of the many assumptions that were used in the 7.5 mph bumper analysis.

National Hwy. Traffic Safety Administration, Washington, D.C. 20590  
1979 ; 12p  
Complete text is HS-804 718.  
Availability: NHTSA

HS-804 722

#### DPMAS [DRIVER PERFORMANCE MEASUREMENT AND ANALYSIS SYSTEM] UTILIZATION. VEHICLE PARAMETER IDENTIFICATION. FINAL SUMMARY REPORT.

By restricting the roll angle of the vehicle to small values fourth order differential equations (which neglect the effects of wheel dynamics, vertical motion, and constrain vehicle motion so that wheels are always on the ground) are shown to be reduced to the classical bicycle model of vehicle motion. Not all of the coefficients in this second order model are measurable but may be computed if the transfer function of the vehicle is known. Using the second order model, plus the well-known result from control theory which implies that the quasilinear behavior of most physical systems is well approximated by linear second order differential equation with variable coefficients, a method has been demonstrated which makes possible the estimation of the transfer function coefficients for the second order model from data taken by the Driver Performance Measurement and Analysis System. A second method has been developed for estimating the bicycle model physical parameters once the yaw rate to steer angle transfer function is known. It was observed that, if the second order model thus estimated gives a reasonable fit to the data, then a very simple measure based on the damping ratio of the second order roots of the model, can be used to display a measure of relative vehicle stability which is a function of both speed and lateral acceleration.

University of Missouri-Rolla, Rolla, Mo.  
DOT-HS-7-01533  
1978 ; 7p  
Technical Report is HS-804 721.  
Availability: Reference copy only



January 31, 1980

HS-804 751

HS-804 748

**PROPOSED PROGRAM IMPLEMENTATION PLAN  
FOR 55 MPH NONCOMPLIANCE AND OTHER  
UNSAFE DRIVING ACTS, FISCAL YEARS 1980 TO  
1984, FOR HIGHWAY SAFETY  
RESEARCH, DEVELOPMENT, AND  
DEMONSTRATION UNDER SECTION 403 OF TITLE  
23, USC**

This plan addresses activities designed to identify, develop, and transfer to the states and to communities, those systems, technologies, guidelines, and information that will help them reduce violations of the 55 mph speed limit and certain other unsafe driving actions (UDA'S) causally associated with traffic accidents (e.g. following too closely, making unsafe entry into traffic flow, driving at unsafe speed for conditions). The highest priority and most of the overall effort called for in this plan are allocated to developing and testing procedures for improving compliance with the 55 mph speed limit. The highest priority programs proposed for development and test include police enforcement and related public information techniques, strategies, and programs designed to deter violations, to increase the risk of detection and apprehension for 55 mph violation, and to alert drivers to this increased apprehension risk; public information and education programs to inform the driving public of the safety and energy benefits of the 55 mph speed limit, thereby improving voluntary compliance; and programs for citizen reporting of individual violators or high violation areas to assist in deterring violations. The plan also covers the development of countermeasure procedures for selected UDA'S. Interface with police traffic services, traffic law adjudication, and driver license plans is anticipated when the results of research included in the plan become available.

National Hwy. Traffic Safety Administration, Office of  
Management Services, Room 4423, 400 7th St., S.W.,  
Washington, D.C. 20590  
1979 ; 22p  
See also HS-804 749--HS-804 758.  
Availability: NHTSA

HS-804 749

**PROPOSED PROGRAM IMPLEMENTATION PLAN  
FOR PEDESTRIAN/BICYCLIST/PUPIL  
TRANSPORTATION PROGRAM, FISCAL YEARS  
1980 TO 1984, FOR HIGHWAY SAFETY RESEARCH,  
DEVELOPMENT, AND DEMONSTRATION UNDER  
SECTION 403 OF TITLE 23, USC**

This plan addresses activities designed to identify, develop, and transfer to the states and to communities, those systems, technologies, guidelines, and information that will help them reduce urban and rural pedestrian accidents, bicycle/motor vehicle accidents, and school bus accidents. Problem identification for newly identified accident situations will receive priority effort. Countermeasures for second priority accident types will be developed and test and demonstration projects conducted. Previously implemented countermeasures will be evaluated. Passing on new developments and management and technical information to the states will be a prime activity. In the rural pedestrian area, major efforts will be devoted to countermeasure development, test, and demonstration. Activities in the area of bicycle/motor vehicle accidents will focus on countermeasure development, test, and demonstration and the transfer of research findings and information on state program efforts. In the area of pupil transportation, attention will be devoted to problem identification, and countermeasure development, test, and demonstra-

tion. Included in the plan is investigation of relevant parts of the Alcohol, Young Driver, and Driver Licensing Area Plans.

National Hwy. Traffic Safety Administration, Office of  
Management Services, Room 4423, 400 7th St., S.W.,  
Washington, D.C. 20590  
1979 ; 21p  
See also HS-804 748, HS-804 750--HS-804 758.  
Availability: NHTSA

HS-804 750

**PROPOSED PROGRAM IMPLEMENTATION PLAN  
FOR STATE PROGRAM MANAGEMENT, FISCAL  
YEARS 1980 TO 1984, FOR HIGHWAY SAFETY  
RESEARCH, DEVELOPMENT, AND  
DEMONSTRATION UNDER SECTION 403 OF TITLE  
23, USC**

This plan addresses activities for improving the capabilities of state and local program management to implement the "process" approach for the state and community Highway Safety Program. The major objective guiding proposed program efforts is to provide the leadership, technical assistance, management procedures and tools, and training programs to states for carrying out efficient and effective highway safety operations. To facilitate the transition from the past "standards" or prescriptive approach to the process approach in safety management, priorities have been established under the following categories: data analysis and problem identification; planning and programming, including the steps and procedures necessary to develop a viable Highway Safety Plan; evaluation, including procedures, methodology, and criteria for conducting impact, administrative, and overall statewide evaluations; and manpower development and training for state, regional, and headquarters personnel. Activities in this program area will interface with most of the other plans, particularly the Traffic Records Plan.

National Hwy. Traffic Safety Administration, Office of  
Management Services, Room 4423, 400 7th St., S.W.,  
Washington, D.C. 20590  
1979 ; 7p  
See also HS-804 748, HS-804 749, HS-804 751--HS-804 750  
Availability: NHTSA

HS-804 751

**PROPOSED PROGRAM IMPLEMENTATION PLAN  
FOR TRAFFIC LAW ADJUDICATION, FISCAL  
YEARS 1980 TO 1984, FOR HIGHWAY SAFETY  
RESEARCH, DEVELOPMENT, AND  
DEMONSTRATION UNDER SECTION 403 OF TITLE  
23, USC**

This plan addresses activities designed to improve the components of the traffic law system that deal with enforcement, adjudication, and sanctions. Efficiency of performance, fairness to motorists, and effectiveness in driver control are the objectives. Planned activities will address the following problems: the lack of education and training for prosecutors, judges, court clerks, and court administrators in the highway safety impact of their role in the traffic law system; the need to simplify and make more efficient the adjudication of minor traffic cases; and the unnecessary practice of immediate arraignment of nonresident traffic violators, which consumes a large amount of police time. The priorities are as follows: training of traffic adjudication professionals, promotion of the Nonresident Violator Compact, development of model information systems for traffic courts, packaging of existing materials on administrative adjudi-

cation for transfer to the states, and testing and demonstration of model traffic adjudication system. Activities in this program area relate to the Enforcement, Driver Licensing, Driver Education, and Alcohol Plans.

National Hwy. Traffic Safety Administration, Office of Management Services, Room 4423, 400 7th St., S.W., Washington, D.C. 20590  
1979; 9p  
See also HS-804 748--HS-804 750, HS-804 752--HS-804 758.  
Availability: NHTSA

## HS-804 752

**PROPOSED PROGRAM IMPLEMENTATION PLAN  
FOR POLICE TRAFFIC SERVICES, FISCAL YEARS  
1980 TO 1984, FOR HIGHWAY SAFETY RESEARCH,  
DEVELOPMENT, AND DEMONSTRATION UNDER  
SECTION 403 OF TITLE 23, USC**

This plan will help to provide effective guidance, and technical assistance to enforcement agencies in order to improve the efficiency and effectiveness of police traffic services and to increase the amount of police effort allocated to traffic services. The plan is designed to use the members of authoritative police organizations and nationally recognized police educational institutions to help identify problems for "product" development by the National Hwy. Traffic Safety Administration, to act as quality control for the product developed, and to help "market" the product or technology transfer within the police community. The necessary technical assistance will be solicited through workshops, advisory groups, and seminars. Police organizations to be used initially include the following units of the International Assoc. of Chiefs of Police: the Hwy. Safety Com., the State and Provincial Div., and the State Police Planning Officer's Section. Future efforts will include the National Sheriffs Assoc., the Traffic Inst. (Northwestern Univ.), and the Southern Police Inst.

National Hwy. Traffic Safety Administration, Office of Management Services, Room 4423, 400 7th St., S.W., Washington, D.C. 20590  
1979; 6p  
See also HS-804 748--HS-804 751, HS-804 753--HS-804 758.  
Availability: NHTSA

## HS-804 753

**PROPOSED PROGRAM IMPLEMENTATION PLAN  
FOR DRIVER LICENSING PROGRAM, FISCAL  
YEARS 1980 TO 1984, FOR HIGHWAY SAFETY  
RESEARCH, DEVELOPMENT, AND  
DEMONSTRATION UNDER SECTION 403 OF TITLE  
23, USC**

The Driver Licensing Plan (DLP) is designed to develop a modern, comprehensive driver control system that will upgrade the general level of driver performance in the U.S. and will contribute to a reduction of the incidence of highway traffic accidents involving unqualified and impaired drivers. The DLP fundamentally seeks to develop socially acceptable policies and procedures for use by the states in administering their driver licensing and driver improvement functions and in detecting and correcting deviant driver behavior. The results expected from research and from demonstration programs in driver licensing will help strengthen and modernize various licensing procedures, will improve postlicensing control and driver improvement activities, will promote more effective use of driver record and enforcement personnel, and will expedite the adjudication

and disposition of traffic offenses. The following program components are proposed to address major deficiencies in the driver licensing system: the "one-license, one-record" concept (addresses the problem of multiple licenses and records, provides improved driver identification and system security, and fills the need for an updated and strengthened Driver License Compact), control of suspended or revoked (S/R) drivers (provides methods for control of S/R drivers through specific countermeasures), measure development, evaluation of "hardship" or "occupational" licensing, technology transfer (provides prompt transfer to driver licensing administrators such products as Traffic Law Commentaries, improved driver screening materials, and better definition of regulatory problems and recommended solutions), model comprehensive driver licensing system (development and implementation), heavy-duty vehicle operators (development of special tests, regulatory procedures, and driver improvement procedures), and medically impaired and elderly drivers (development of risk levels, along with medical criteria and matching of driver disabilities to licensing restrictions, provision of guidelines for assisting elderly drivers in personally meeting and compensating for medical problems).

National Hwy. Traffic Safety Administration, Office of Management Services, Room 4423, 400 7th St., S.W., Washington, D.C. 20590  
1979; 22p 30refs  
See also HS-804 748--HS-804 752, HS-804 754--HS-804 758.  
Availability: NHTSA

## HS-804 754

**PROPOSED PROGRAM IMPLEMENTATION PLAN  
FOR NATIONAL DRIVER REGISTER, FISCAL  
YEARS 1980 TO 1984, FOR HIGHWAY SAFETY  
RESEARCH, DEVELOPMENT, AND  
DEMONSTRATION UNDER SECTION 403 OF TITLE  
23, USC**

The National Driver Register (NDR) is designed to assist states in identifying and controlling problem drivers, thereby reducing accidents and the resultant injuries, fatalities, and property damage. Concurrently with the continuing operation of the NDR, the development of a replacement system with rapid response capability that is responsive to expressed state needs is being pursued on a priority basis. It is planned to operate a pilot system in four states during FY 1981 for purposes of demonstration and evaluation. Upon favorable evaluation of the system, it is planned to phase four states into the system annually until all users desiring rapid response capability are accommodated. Other users would participate through the mails as before.

National Hwy. Traffic Safety Administration, Office of Management Services, Room 4423, 400 7th St., S.W., Washington, D.C. 20590  
1979; 10p  
See also HS-804 748--HS-804 753, HS-804 755--HS-804 758  
Availability: NHTSA

## HS-804 755

**PROPOSED PROGRAM IMPLEMENTATION PLAN  
FOR MOTORCYCLE AND MOPED PROGRAM,  
FISCAL YEARS 1980 TO 1984, FOR HIGHWAY  
SAFETY RESEARCH, DEVELOPMENT, AND  
DEMONSTRATION UNDER SECTION 403 OF TITLE  
23, USC**

This plan addresses activities for improved motorcycle and moped safety. The proposed program efforts are designed

develop an internal planning document to guide National Hwy. Traffic Safety Administration (NHTSA) officials and program managers in preparing program strategies and necessary resource requirements, and to provide the public, private groups, and government at all levels with insight into NHTSA'S plans. The plan will permit these groups to comment during the early stages, and will permit the motorcycle and moped industry and appropriate government agencies to anticipate NHTSA actions in their own planning. The overall goal is to reduce motorcycle and moped accidents, injuries, and fatalities. The following program areas are given the highest priority: conspicuity, with emphasis on both rider and vehicle visibility; operator education and training, including both novice and experienced operators; operator licensing, including development of a complete licensing system; rider protection, with particular attention to helmet usage; and moped safety, involving program development to counter predicted safety problems inherent in increased moped use. Activities in this area are closely related to those of the Young Driver and Driver Licensing Plans.

National Hwy. Traffic Safety Administration, Office of Management Services, Room 4423, 400 7th St., S.W., Washington, D.C. 20590

1979 ; 24p 3refs

See also HS-804 748--HS-804 754 HS-804 756--HS-804 758.

Availability: NHTSA

#### HS-804 756

### **PROPOSED PROGRAM IMPLEMENTATION PLAN FOR YOUNG DRIVER, FISCAL YEARS 1980 TO 1984, FOR HIGHWAY SAFETY RESEARCH, DEVELOPMENT, AND DEMONSTRATION UNDER SECTION 403 OF TITLE 23, USC**

This plan addresses activities to reduce the vast number of young drivers involved in highway accidents. The two problem groups addressed are the novice driver (generally aged 16 to 19) and the young driver (aged 20 to 24). The scope of the planned efforts includes not only the licensing of young drivers at age 16 but also safety activities, particularly educational projects, directed at the younger, predriver groups. Although prevention (through driver education and licensing programs) is the primary area of emphasis, the detection and driver control functions of the police, courts, and rehabilitation agencies have an important role. Emphasis is also placed therefore on enforcement, adjudication, driver improvement, and sanction programs directed at the young driver. The overall goal is to prevent accident occurrence through teaching effective skills, providing traffic safety information, instilling safe-driving attitudes, and using improved licensing procedures, coupled with the general and specific deterring effects of appropriate enforcement, adjudication, and driver improvement and retraining programs. Activities in this plan interface with those in the alcohol, speeding motorcycle, safety belt, and safety support system plans.

National Hwy. Traffic Safety Administration, Office of Management Services, Room 4423, 400 7th St., S.W., Washington, D.C. 20590

1979 ; 37p 12refs

See also HS-804 748--HS-804 755, HS-804 757, and HS-804 758

Availability: NHTSA

#### HS-804 757

### **PROPOSED PROGRAM IMPLEMENTATION PLAN FOR EMERGENCY MEDICAL SERVICES, FISCAL YEARS 1980 TO 1984, FOR HIGHWAY SAFETY RESEARCH, DEVELOPMENT, AND DEMONSTRATION UNDER SECTION 403 OF TITLE 23, USC**

The Emergency Medical Services (EMS) Program is designed to ensure that victims of traffic accidents and medical emergencies receive prompt and adequate emergency care. This plan addresses activities for a comprehensive EMS system that includes emergency equipment, manpower, and facilities. The following specific traffic safety program goals are listed in priority order: to develop additional criteria for evaluating EMS system effectiveness and societal value, to formulate guidance for rural EMS development, to update and maintain EMS-RELATED training programs, to develop guidance for best use of the EMS system elements, and to assess and take advantage of available technological opportunities (both hardware and software) to reduce the cost and increase the effectiveness of the EMS system. Activities in this program area interface with those of the following individual implementation plans: Driver Licensing, Motor Vehicle Registration, Motor Vehicle Inspection, Police Traffic Services, Debris Hazard Control and Cleanup, Traffic Records, and Driver Education.

National Hwy. Traffic Safety Administration, Office of Management Services, Room 4423, 400 7th ST., S.W., Washington, D.C. 20590

1979 ; 26p 8refs

See also HS-804 748--HS-804 756, and HS-804 758

Availability: NHTSA

#### HS-804 758

### **PROPOSED PROGRAM IMPLEMENTATION PLAN FOR OCCUPANT RESTRAINT USAGE, FISCAL YEARS 1980 TO 1984, FOR HIGHWAY SAFETY RESEARCH, DEVELOPMENT, AND DEMONSTRATION UNDER SECTION 403 OF TITLE 23, USC**

This plan addresses activities to increase the number of people who use occupant restraints (active safety belts, air bags, automatic belts, child restraints) while traveling in motor vehicles. The five primary areas of activity are research, development, and pilot testing of various approaches for promoting restraint usage; education programs (including workshops) and materials distribution efforts; a coordinated mass media program; evaluation of education media, and legislative efforts; and assessment of restraint usage. The highest priority is program and countermeasure development, including workshops for advocacy groups and a coordinated mass media public information program. Secondary priority is given to program evaluation and evaluation support for state programs. Two other programming areas within the scope of Section 403 are the research and development of hardware by the Office of Passenger Vehicle Research, and the multidisciplinary accident investigation efforts involving occupant restraints by the National Center for Statistics and Analysis.

National Hwy. Traffic Safety Administration, Office of Management Services, Room 4423, 400 7th St., S.W., Washington, D.C. 20590

1979 ; 24p 2refs

See also HS-804 748--HS-804 757.

Availability: NHTSA

HS-804 759

HSL 80-01

HS-804 759

**APPENDICES TO THE FIVE YEAR PLAN FOR MOTOR VEHICLE SAFETY AND FUEL ECONOMY RULEMAKING, CALENDAR YEARS 1980-1984**

Except for fuel economy rulemaking, which was addressed in the main body of the plan, a detailed discussion is presented of the contemplated motor vehicle safety rulemaking activities included in the rulemaking plan. The appendices are presented in three sections in the order that they appear in the plan. Appendix A describes the near-term rulemaking, where information now available appears sufficient to justify Federal rulemaking activity. Appendix B describes the proposed technical amendments, minor rulemaking actions to clarify existing requirements or to resolve specific technical problems. Appendix C describes exploratory research and rulemaking activities, where there is obvious need for improvement but where precise solutions have not been developed or the role of Federal regulation has not been defined. Each rulemaking action is described by title, objective, applicability, safety problem, approach, and schedule (where appropriate).

National Hwy. Traffic Safety Administration, 400 7th St., S.W., Washington, D.C. 20590  
1979 ; 78p  
Availability: NHTSA

HS-804 786

**WORKSHOPS ON TECHNOLOGICAL CHANGE IN THE U.S. AUTOMOBILE INDUSTRY, OCTOBER 1977 THROUGH APRIL 1978, AND SYMPOSIUM ON TECHNOLOGY, GOVERNMENT AND THE AUTOMOTIVE FUTURE, OCTOBER 19-20, 1978, PROCEEDINGS. FINAL REPORT**

The purpose of five workshops and a final symposium held at Harvard Univ. during 1977 and 1978 was to explore the implications of technological change in the U.S. automotive industry in support of improved policy formulation to meet emerging national needs. The impetus for these changes originates mainly in direct government policy, but also in diminished energy resources, and international competition. The meetings were designed to gather insight and understanding from specialists who have intimate knowledge about problems and opportunities for improvement. A unique objective of this program has been to engage a broader range of participants than heretofore in a constructive effort to promote progress in a form consistent with national needs. The five workshops dealt with the motor vehicle regulatory process, the consumer and the supply industry as factors in motor vehicle innovation, changing incentives for motor vehicle research and development, and the role of national and multinational corporations in motor vehicle innovation. The five key issues emanating from these workshops were the Federal research and development policy in the motor vehicle sector, product rating information for consumers, regulatory decision-making, regulation and international trade, and transportation policy.

by William J. Abernathy, Ed.; Douglas H. Ginsburg, Ed.  
Harvard Univ., Graduate School of Business Administration,  
Soldiers Field Rd., Boston, Mass. 02163  
DOT-TSC-1384  
Rept. No. DOT-TSC-NHTSA-79-33 ; 1979 ; 412p refs  
Rept. for Oct 1977-Apr 1979. Includes HS-805 136, HS-810 352, and HS-027 364--HS-027 370. Meetings jointly sponsored by Dept. of Transportation and Harvard Business School. Only symposium papers with DOT support included; others will be available in a text published by McGraw-Hill Book Co.  
Availability: NTIS

HS-804 910

**ADVANCED MOTORCYCLE HANDLING AND DYNAMICS. VOL. 1: SUMMARY TECHNICAL REPORT. FINAL REPORT**

by R. Schwarz  
South Coast Technology, Inc., P.O. Box 3265, Santa Barbara, Calif. 93105  
DOT-HS-7-01722  
1979 ; 14p  
Rept. for Oct 1977-Apr 1979. For abstract, see HS-804 911, Vol. 2, Final Technical Report. Vol. 3, Appendix A, is HS-804 913  
Availability: NTIS

HS-805 037

**RESEARCH INPUT FOR COMPUTER SIMULATION OF AUTOMOBILE COLLISIONS. VOL. 1. DEVELOPMENT OF DATA BANK. FINAL REPORT**

The results are summarized of a detailed review of existing experimental data from staged automobile collisions, and long range plans are presented to meet future data needs in relation to computer aids for reconstruction of highway accidents. A total of 141 staged collisions involving 170 individual vehicles with usable damage information were reviewed. The experimental damage data were coded and entered in a computerized data bank which was developed within the research program. Only seven staged collisions were found to include usable documentation of data from the spinout trajectories of the vehicles. Detailed plans are presented for application of the developed data bank. A sample application to refine the empirical structural crush tables of the CRASH (Calspan Reconstruction of Accident Speeds on the Highway) program is included in the report. All data collected within the research program are appended.

by Raymond R. McHenry; James P. Lynch; David J. Segal  
Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221  
DOT-HS-7-01511  
Rept. No. ZQ-6057-\*V-3 ; 1978 ; 116p 65refs  
Rept. for Dec 1976-Jun 1977. Vol. 2-4 are HS-805 038--HS-805 040.  
Availability: NTIS

HS-805 040

**RESEARCH INPUT FOR COMPUTER SIMULATION OF AUTOMOBILE COLLISIONS. VOL. 4. STAGED COLLISION RECONSTRUCTIONS. FINAL REPORT**

Computer reconstructions of the twelve staged collisions presented in Volumes 2 and 3 are described and evaluated. Results of the CRASH (Calspan Reconstruction of Accident Speeds on the Highway) II program were judged on their degree of correspondence with the measured impact speeds and changes in velocity. Reconstructions using the SMAC (Simulation Model of Automobile Collisions) program were assessed on the basis of the accuracy of the predicted final rest positions, damage dimensions, and changes in velocity. On the whole, the results from both the reconstruction programs were satisfactory. Recommendations are made to update representative values of vehicle characteristics used in the CRASH II program; to add a stationary vehicle option to the CRASH program; to simulate hard points and corner effects in the SMAC program; and to provide an option to input tire cornering stiffness time history data in order to simulate weight transfer effects.

by Ian S. Jones; A. S. Baum  
 Calspan Corp., Advanced Technology Center, P.O. Box 400,  
 Buffalo, N.Y. 14225  
 DOT-HS-7-01511  
 Rept. No. ZQ-6057-\*V-6 ; 1978 ; 185p  
 Rept. for Jun 1977-Dec 1978. Vol. 1-3 are HS-805 037--HS-805  
 039.  
 Availability: NTIS

HS-805 046

# **RESEARCH INPUT FOR COMPUTER SIMULATION OF AUTOMOBILE COLLISIONS. INTERIM REPORT**

Results are summarized of a detailed review of existing experimental data from staged automobile collisions, with long range plans to meet future data needs in relation to computer aids for reconstruction of highway accidents. A total of 141 staged collisions involving 170 individual vehicles with usable damage information were reviewed. The experimental damage data were coded and entered in a computerized data bank which was developed within the research program. Only seven staged collisions were found to include usable documentation of data from the spinout trajectories of the vehicles. Detailed plans are presented for application of the developed data bank. A sample application to refine the empirical structural crush tables of the CRASH program is included in the report. All data collected within the research program are appended.

by Raymond R. McHenry; James P. Lynch; David J. Segal  
 Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221  
 DOT-HS-7-01511  
 Rept. No. ZQ-6057-\*V-1 ; 1977 ; 116p 65refs  
 Rept. for Dec 1976-Jun 1977.  
 Availability: NTIS

HS-805 049

# **COLLISION AVOIDANCE RADAR BRAKING SYSTEMS INVESTIGATION - PHASE 3 STUDY. FINAL TECHNICAL REPORT**

The final report is presented of the Phase III program to study the potential application of an anticipatory radar braking system in preventing motor vehicle accidents. The design of the experimental radar braking system by Bendix Res. Labs. is described, including the installation of the system on two test vehicles. A summary of the functional tests which demonstrate the performance of the experimental system is also included. The system description follows an introductory general discussion (section 1). Section 2 outlines the design of the radar sensor, including the signal processing electronics, control panel display, and installation of the entire subsystem on the test vehicles. Sections 3 and 4 describe the design of the brake actuation subsystem and the anti-lock subsystem, respectively, and include information about installation of these two subsystems on test vehicles. Section 5 outlines functional tests conducted with the two test vehicles equipped with the radar braking system which demonstrate system performance. In addition to general observations about closed-loop braking performance of the two radar-brake-equipped test vehicles, Section 6 outlines the major differences in performance between the two test vehicles. More extensive tests of the radar braking system installed in the test vehicles are recommended. A test plan, separate from this report, has been submitted.

by William R. Faris; Carl P. Tresselt; Henry C. Yee  
 Bendix Corp., Bendix Res. Labs., Southfield, Mich. 48076  
 DOT-HS-6-01450  
 Rept. No. 8904 ; 1979 ; 249p 7refs  
 Rept. for Sep 1976-May 1979.  
 Availability: NTIS

HS-805 050

# **COLLISION AVOIDANCE RADAR BRAKING SYSTEMS INVESTIGATION. PHASE 3 STUDY. FINAL REPORT**

A prototype Collision Avoidance Radar Braking System was installed on two vehicles and limited performance testing was carried out; further testing under varying conditions is required. Test methodology is described: parameters such as system sensitivity, dynamic braking performance on curves, and performance in the presence of precipitation are recommended for testing in a controlled test-track environment and in highway driving. Test-track requirements and target profiles (both simulated and real) are described. Recommended test instrumentation is described and data collection procedures outlined, including order of testing, number of runs, recorder speed, correlation with visual observations, and speed and brake temperature measurement. The continued test program should cover approximately eight months; a schedule for specific tests is suggested.

by William R. Faris  
 Bendix Corp., Bendix Res. Labs., Southfield, Mich. 48076  
 DOT-HS-6-01450  
 Rept. No. 8940 ; 1979 ; 25p 3refs  
 Rept. for Sep 1976-May 1979.  
 Availability: NTIS

HS-805 051

# **VISUAL DETECTION OF DRIVING WHILE INTOXICATED. PROJECT INTERIM REPORT: IDENTIFICATION OF VISUAL CUES AND DEVELOPMENT OF DETECTION METHODS**

The initial phase is described of a two-phase project designed to develop and test procedures for enhancing on-the-road detection of driving while intoxicated (DWI). The emphasis of the first phase was on the identification of visual cues and the development of procedures that effectively discriminate between DWI and driving while sober (DWS). The literature was reviewed, expert opinion was surveyed, 1288 DWI arrest reports were analyzed, and an on-the-road detection study was conducted in which trained observers accompanied police officers on patrol and recorded 643 instances of driving behavior and vehicle actions that deviated from normal. In each instance, the patrol officer stopped the vehicle and measured the blood alcohol concentration (BAC) of the driver with a portable breath tester. A DWI detection guide was developed to facilitate the application of research findings to the on-the-road detection of DWI by police patrol officers. The guide consists of 23 visual cues, a value for each cue reflecting the ability of the cue to discriminate between DWI and DWS, and a set of three rules for estimating the probability of DWI for any set of observed cues. The 23 cues accounted for 92 percent of the cues observed during the detection study. It was concluded that alcohol-induced driver impairment is exhibited mainly in steering and velocity control, time-sharing of attention, and information processing. Development of the detection guide was governed by the following criteria: to account for the largest number of detection events with the smallest number of detection cues; to enhance the discriminability of available cues; to employ a pro-

babilistic output; to accommodate multiple-cue occurrences; to accommodate alternative enforcement statutes, policies, and strategies; and to emphasize simplicity, practicality, and ease of use. Prior to making the guide generally available or implementing its use on a wide scale, a field test is required to evaluate its effectiveness.

by Douglas H. Harris; James B. Howlett; R. Glen Ridgeway  
Anacapa Sciences, Inc., P.O. Drawer Q, Santa Barbara, Calif.  
93102

DOT-HS-7-01538

Rept. No. 321-1 ; 1979 ; 141p 25refs

Rept. for Mar 1977-Jan 1979.

Availability: NTIS

HS-805 053

**SMALL CAR DRIVER INFLATABLE RESTRAINT SYSTEM EVALUATION. VOL. 2: DRIVER AIR CUSHION RESTRAINT (ACRS) DEVELOPMENT FOR 1976 VEGA, VALIANT, AND CHEVETTE SUBCOMPACT VEHICLES. FINAL REPORT**

Sled tests (76) and car crash tests (7) were conducted to evolve production driver restraint systems for three Government furnished vehicles: 1976 Vega, Valiant, and Chevette. The effort was successful in providing 30-mph barrier equivalent velocity driver protection for all three vehicles. Resulting injury measurements were well within the limits set by the FMVSS 208 injury criteria. Protection was provided without changing the compartment interior geometry (except for the space required by the knee restraints), the column angle, or the driver's normal seating position. Although in the initial investigations the GM ACRS wheel and bag assembly (inflator, bag, cover) had been selected, it was later found necessary to substitute several system components to bring the vehicle systems into compliance with FMVSS injury criteria. The GM bag was modified to 120% of its original volume and an inflator with a correspondingly increased gas output was used. The stock energy absorbing steering column units of the Vega and Chevette were found to be too sensitive to the bending moments created by vertical loads at the wheel rim and were thus replaced by the Minicars tube/mandrel collapsible steering column, a system which easily satisfies industry standard torque criteria for steering columns. To assure controlled column collapse, the original column support bracketry was strengthened and molybdenum-impregnated nylon runners were installed. The appendix includes Vega sled test measurements and car crash tests, Valiant and Chevette sled tests, Chevette car crash tests, and oblique impact simulation for the Chevette. 1e,

by W. Broadhead; C. Strother

Minicars, Inc., 55 Depot Rd., Goleta, Calif. 93017

DOT-HS-6-01412

1978 ; 332p

Rept. for Aug 1976-Aug 1978. Vol. 1, Executive Summary, is HS-805 052; Vol. 3, Investigation of Potential Crash Survivability of a Current Production Subcompact Vehicle Equipped With an Advanced Driver Restraint System, is HS-805 054; Vol. 4, Evolving a Low Mount Passenger Air Cushion Restraint System (ACRS) For the Vega Subcompact Vehicle, is HS-805 055.

HS-805 062

**EXECUTIVE AND TABULAR SUMMARY OF AIR BAG FIELD EXPERIENCE. VOL. 3, NO. 1. FINAL REPORT**

Narrative summaries and tables describe a total 57 accidents involving air bag equipped cars, which were reported to NHTSA from 1 Sep 1977 through 31 Aug 1978 (33 deployment cases and 24 nondeployment cases). The information was extracted from the NHTSA in-depth reports by accident investigation teams from five regional research stations. In each case the following data are included: date, location, DOT HS number, type of accident, year and make of other vehicle(s) involved, speed of impact, driver and passenger(s) information, their injury codes, damage to the vehicles, and damage codes.

by Lotta Chi  
Chi Associates, Inc., Suite 316, 1011 Arlington Blvd., Arlington, Va. 22209

NHTSA-9-6611

1979 ; 53p

Rept. for 1 Sep 1977 - 31 Aug 1978.

Availability: NTIS

HS-805 063

**DEVELOPMENT OF A TEST METHODOLOGY FOR EVALUATING CRASH COMPATIBILITY AND AGGRESSIVENESS. VOL. 1, SUMMARY REPORT. FINAL REPORT**

A test methodology was devised for evaluating crash compatibility and aggressiveness of intermediate, subcompact and lightweight subcompact cars. The NHTSA Test Device was developed to measure the basic types of aggressiveness, namely architectural, mass and structural aggressiveness. The Test Device is a unique segmented honeycomb load-measuring tool which is adaptable to both moving barrier and fixed barrier collisions. The design criteria for the Test Device are summarized; results of eight car-to-Test Device collisions given; a summary of the analysis and comparison of previous crash test data presented; and methods discussed for assessing vehicle crash compatibility and aggressiveness.

by S. Davis; R. Yee

Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix, Ariz. 85027

DOT-HS-7-01758

Rept. No. 8316-78-171A ; 1979 ; 40p 6refs

Rept. for Sep 1977-Dec 1978.

Availability: NTIS

HS-805 068

**LONG LIFE HYDRAULIC BRAKE SYSTEM. SUMMARY REPORT. FINAL REPORT**

An analytical and experimental program was conducted to design a long life brake system for passenger vehicles which would double the period between required servicing of conventional systems. The design approach was to be compatible with existing vehicle configurations and not to differ radically in braking principle. Formal objectives were: to analyze the state-of-the-art hydraulic brake systems, identifying system assembly and/or component design requirements which will assure a significant increase in service life without maintenance or repairs, and which will not affect safety, performance, or fuel economy; to develop techniques which can be utilized objectively in quantifying system durability and recommend procedures suitable for

use in compliance testing. Service life was found initially to be defined by friction pair maintenance in the 30,000 to 40,000 mile range. Subsequent servicing requirements were necessitated by a number of mechanisms derived in large part from fluid degradation, metal corrosion, and rubber deterioration. A long life design approach was specified satisfying a doubled friction pair lifetime and a 100,000 mile balance of system service-free life. Component-by-component design approach alternatives were given and three test procedures described with which to evaluate compliance with the postulated standard: brake fluid specification modification, system isolation/cycling test, and dynamometer wear cycle. Benefit-cost analysis demonstrated that the benefits of reduced accidents and consumer maintenance outweigh the costs.

by R. Ziskind; I. Osofsky; Y. Mansoor; F. Oldham; D. Cout  
Science Applications, Inc., 1801 Ave. of the Stars, Suite 1205,  
Los Angeles, Calif. 90067  
DOT-HS-7-01776  
Rept. No. SAI-068-80-516 ; 1979 ; 36p 10refs  
Rept. for Oct 1977-Mar 1979.  
Availability: NTIS

HS-805 078

#### **DEVELOPMENT OF AERODYNAMIC DISTURBANCE TEST PROCEDURES. VOL. 1: EXECUTIVE SUMMARY. FINAL REPORT**

by Richard H. Klein; Jeffrey R. Hogue  
Systems Technology, Inc., 13766 South Hawthorne, Blvd.,  
Hawthorne, Calif. 90250  
DOT-HS-7-01716  
Rept. No. STI-TR-1117-1-\*1 ; 1979 ; 33p 10refs  
Rept. for 30 Sep 1977-30 Mar 1979. For abstract, see Vol. 2,  
HS-805 079.  
Availability: NTIS

HS-805 136

#### **CONSUMER SAFETY INFORMATION AS A GOVERNMENT POLICY TOOL**

The influence of safety information on the consumer's automobile purchase decision is discussed, with particular reference to the National Hwy. Traffic Safety Administration's (NHTSA) consumer information program as authorized by Title II of the Motor Vehicle Information and Cost Savings Act of 1972. This Act authorized NHTSA to rate the comparative performance of automobiles with respect to crashworthiness, damageability, and ease of maintenance, and to provide information on each of these factors to the public. Extensive studies conducted since the Act was implemented indicate that consumers say that they are concerned about vehicle safety, but that the vast majority assume that all cars within a size class are equally safe. A Dept. of Transportation-sponsored survey found that the public's understanding of technological alternatives that can improve safety is deep, and its desire for additional information strong, although to date the public has had little access to information about car differences. In view of the decreases in sales of Ford Pintos, Firestone 500 tires, and Chrysler's Omni/Horizon after national publicity about their safety problems, it is clear that consumers act upon safety information when it is provided. Manufacturers respond to this consumer behavior in their advertising. The government disseminates consumer information in order to have consumers react in the marketplace to safety differences and to encourage companies to respond to consumers' desire for safety by upgrading products. The question that remains to be answered is whether consumer information based

on qualitative ratings of the relative crashworthiness of cars creates the same reaction as well-publicized, life-threatening situations. This is a question NHTSA hopes to answer in developing its automotive ratings program.

by Michael M. Finkelstein  
National Hwy. Traffic Safety Administration, Washington, D.C. 20590  
Publ: HS-804 786 (DOT-TSC-NHTSA-79-33), "Workshops on Technological Change in the U.S. Automobile Industry and Symposium on Technology, Government and the Automotive Future Proceedings," Washington, D.C., 1979 p87-99  
1979 ; 12refs  
Presented at Symposium, Cambridge, Mass., 20 Oct 1978.  
Availability: In HS-804 786

HS-810 352

#### **REGULATION AND INNOVATION IN THE AUTOMOBILE INDUSTRY**

At least six forces influence the rate of auto industry innovation as well as its focus, often interacting: internal stimulus; market structure; inventions; independent research; public expectations or crises; and government regulation. Since the 1930's, innovations in the auto industry have chiefly been those that benefit the manufacturer rather than the purchaser. Large auto companies tend to rely for advances in technology on their suppliers, whose research and development is rigidly constrained by the priorities of the giant manufacturers. The Office of Management and Budget urges Federal support of small business through the contracting and procurement process. Firms with less than 1,000 employees accounted for almost 1/2 of major U.S. innovations during 1953-73. Product competition based on technological advances has been abandoned by manufacturers in favor of the model year change, based on styling, and dealer-franchising policies--disincentives to innovation. Health and safety developments may be repressed by industry opposition, and inventions of safety and emission equipment shelved. Research by independent organizations and Government stimulates innovation by identifying critical problems and developing new concepts or hardware. Experimental safety vehicle program work was unsuccessfully attempted by domestic industry, yet satisfactory safety vehicles were produced through foreign industry. DOT is working on two new vehicles, small in weight, high in fuel economy, and with 40 to 50 mph crash survivability characteristics. The Insurance Institute for Highway Safety has played a major role in reducing vehicle damageability, developing an independent data system based on insurance industry information, and seeking the recall of defective vehicles. Consumer expectations have focussed in the past decade on safety and fuel economy. Future trends may be affected by the current overall reduction in the commitment of resources to civilian research and development, both in industry and government. High inflation and interest rates discourage investment in long-term research projects, but safety, conservation, health, and environmental regulatory programs contribute to control of inflation.

by Joan Claybrook  
National Hwy. Traffic Safety Administration, Washington, D.C. 20590  
1978 ; 30p 19refs  
Presented at Symposium on Technology, Government and the Automotive Future, Cambridge, Mass., 20 Oct 1978. Also in HS-804 736  
Availability: Corporate author



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January 31, 1980

1980 TO 1984, FOR HIGHWAY SAFETY RESEARCH, DEVELOPMENT, AND DEMONSTRATION UNDER SECTION 403 OF TITLE 23, USC

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